WONDER STORIES OF DISCOVERY AND INVENTION

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See Page 45

REMINGTON SCHUYLER

"RIGHT OR WRONG, THE COP ALWAYS WINS"

Motorists' Experiences With Roadside Traffic Courts—page 9

POPULAR SCIENCE MONTHLY, PUBLISHED AT 250 FOURTH AVENUE, NEW YORK

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Feel the balance, with the weight where it should be to give driving force with an easy swing.

See that large face that lets every blow strike true; the knife-like claws with the Plumb "curve" that draw any nail with ease.

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In your hardware store—try a Plumb. Then use your own judgment.

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with the
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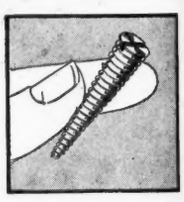
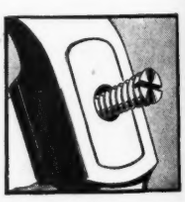
Plumb Take-Up Wedge Keeps Handle Tight

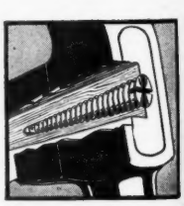
Here is the wedge, invented and used only by Plumb, that keeps handles always tight. See how it tapers from top to tip; how big and sturdy the threads are.



When this wedge is inserted into the tapered hole, its V shape expands the wood against all sides of the eye, all the way in the hammer head.



When the handle works loose (and all handles do, because wood will shrink) you give the wedge a turn and the handle is solid and firm again for a long period of use.



POPULAR SCIENCE MONTHLY
SUMNER N. BLOSSOM, Editor
September, 1926

RIGHT OR WRONG—

The COP Always WINS

You can't be an autoist and avoid breaking laws, thanks to chaotic traffic rules that make czars of village constables—How to protect yourself

By Edgar C. Wheeler

A FEW weeks ago a mechanical engineer of national reputation was touring through Ohio when, on the open road approaching a small village, a motorcycle policeman darted from a clump of bushes, roared up from behind, and arrested him for speeding.

The engineer eyed his captor suspiciously, for he knew he had been traveling at an unusually safe pace.

"You mean to say I was exceeding the speed limit, officer? Why, I'm certain I was doing under twenty-five."

"Tell that to the judge," snapped the cop, whose badge, now displayed on the lining of his coat, revealed that he was a village constable. "I clocked you and I know how fast you were going."

The justice of the peace, before whom the engineer was forthwith hauled, presided behind the counter of the village general store. From among the groceries on a shelf he pulled a clutter of record books and papers, and opened court. The engineer, after telling who he was, explained that he had been experimenting with machines for many years and, aware of the dangers in gasoline motors, was always particularly careful never to drive at a hazardous speed.

"How fast did you say this man was traveling, constable?" asked the justice.

"Forty-five miles an hour!"

By this time the engineer was beginning to get hot under the collar. "But I *was* traveling less than twenty-five," he protested, "and I can prove it, too, if you will ask the constable to point out the spot by the roadside where he was hiding when I came along."

The justice finally consented. When they had inspected the scene, measuring with the speedometer the distance between the officer's ambush and the spot where the arrest was made, the engineer drew a slip of paper from his pocket and hastily sketched a diagram. Then, with a few simple calculations, he demonstrated that, had he been going at the speed of which the constable accused him, the officer himself would have had to travel at more than 100 miles an hour in order to overtake him where he did!

The squire, bewildered, scratched his head. "Well, now," he drawled at last, "what you say is mighty interesting. At first I was going to fine you fifty dollars, but now I guess I'll let you off with only twenty-five!"

As an actor in this roadside comedy, the engineer stood helpless. In the end, what else could he do but fish down in his pocket, pay the fine and go on his way?

What else, in fact, can be the fate of any one of the thousands of motorists who every year find themselves in much the same predicament, and who helplessly pay blood money exacted from them along the nation's highways?

For the speed cop always wins. You may argue, and plead, and protest and rage all you please, but in the end you can't beat him. Usually it is your word against his. The judge never saw you before. He sees the officer every day. He is the dictator of the road, whose word is as good as the law. Sometimes he is right; other times he is wrong. But right or wrong, he can make the motorist pay.

NO ONE doubts, of course, that traffic officers and traffic laws are necessary. They will always be necessary so long as dangerous drivers burn up the highways and kill us off at the rate of more than twenty thousand a year. No one doubts, either, that many traffic officers are honest men who work conscientiously to keep traffic moving safely and to nail those who operate motor cars without thought for the rights or lives of others. And there are certainly many magistrates who, aware of the power of the traffic cop, do not always assume that the motorist is always wrong.

On the other hand, as recent investigations have revealed, and as you, perhaps, can testify, the roads are infested also with another type of speed cop—highwaymen, who hold you up and rifle your pockets with the boldness of a Jesse James. They have the law

They're Stacked Against You

DID you know that any time and anywhere you take a spin in your car you probably are breaking one or more traffic rules without being aware of it; and that, if caught, you have hardly a chance of getting away without a fine?

In the accompanying article are revealed some startling facts brought to light by recent investigations of conflicting laws and of the men who, under the cloak of legal authority, prey upon the motoring public, collecting ransom money.

If you value your purse you'll be interested in reading of the efforts now being made to clear the roads of those who are making a farce of honest efforts to regulate traffic.

on their side—in fact, the law pays them. They can't lose, any more than you can win. They set traps for you and hide in ambush, waiting for the chance to pounce and collect. And to make their positions more secure, often their accomplices are village magistrates and justices of the peace who are supposed to be duty bound to dispense justice for all. With these accomplices they split the booty, dividing fees which the law allows for collecting your fine money. Some act as the paid holdup men for towns or villages, turning the proceeds of their raids into the village coffers and so relieving the citizens of the inconvenience of paying taxes.

These are some of the things that have been making a farce of honest efforts to enforce traffic laws and regulations.

So critical has the situation become, in fact, that the American Automobile Association and its affiliated clubs recently undertook a crusade of exposure and prosecution to put a stop to roadway piracy. Some of the results have been startling. Such figures as have been compiled, for instance, indicate that of all the thousands who are haled into traffic courts, more than ninety-five percent are convicted; mostly they are treated as perjurers whose sworn oaths are not worth the snap of a finger.

ONE combination which is hard to beat was brought to light not long ago in a Pennsylvania village so small that its name doesn't appear on the road maps. Business had been so good for the justice of the peace in this village that he came to be known as "the fining squire." There was one good reason for his prosperity. The village constable was his own son! Another reason was that along the highway through "the heart of the village," consisting of four scattered farmhouses, they had rigged up a little "stop" sign which only the sharpest-eyed motorists could see without binoculars. Further, they had set a speed limit of ten miles an hour.

Son constable would haul in passing tourists and father judge would slap on a fine. At last, when they were called to account, it was revealed that "the fining squire" and his son each had been cleaning up more than $5,000 a year! They had kept absolutely no record of at least two thirds of the fines collected.

IN ALMOST every state there might be named a village or town whose treasury has been fattened in much the same way. For example, there is a village lying in the upper part of New York state, whose two hundred souls, the records show, have not paid a cent of taxes in several years. Passing motorists have paid all the village running expenses—some $25,000 a year. The collectors are two speed cops who conceal themselves in the bushes at the extremities of a measured distance along the highway. Their watches are synchronized. When a machine which looks like good meat for the trap passes, the first cop signals his partner and notes the time. At the end of the distance the second cop notes the time also. They have the "speeder" clocked; and if the driver fails to halt, they also have his license number so that they can mail him a summons.

A similar system was employed with marked success not long ago by a town near New York City when it wanted money for road pavement. The town officials simply hired two "officers" to do the watch stunt; and the motorists from other towns and states paid for the paving!

A Summons to Court

If you've driven a car for any length of time you are a lawbreaker. You can't help being one. As long as every village, town and state in the country has its own traffic laws, which it is impossible for any one motorist to learn, you will continue to be one. Uniform traffic codes are acknowledged to be the only possible remedy

One of the most deceptive snares is the "silent policeman" at road intersections in many small towns. Virtually everywhere the general understanding seems to be that when no outspoken officer is on duty at one of these dumb statues, you are supposed to go around it. If an officer is on duty you're supposed to do what he says. Yet every so often you will run across a silent cop that seems to possess the mysterious faculty of getting you in bad, coming or going.

A month or so ago a young woman acquaintance of mine was driving her father from their summer vacation spot to a certain railway station in Connecticut, where he was to catch the train. On the way she came upon one of these silent policemen, placed where her road ended at an intersecting highway, forming a "T." Instead of being in the center of the intersection, however, the post was placed so near the far curb that it would have been next to impossible for a large car to pass around it and enter the main road without scraping a fender.

The young woman hesitated a moment; and then, as no officer and no cars were in sight, she cut across in front of the post.

Instantly a man in street clothes stepped out from the curb and yelled at her to stop. Unbuttoning his coat, he displayed a constable's badge pinned on his vest, and informed her she was under arrest.

"Haven't you got sense enough to go around the post when no officer is there?" he shouted.

"Sure," retorted the girl with spirit. "But didn't I see you standing there a minute ago?"

FOR answer he led the way to the town undertaker, who also was justice of the peace. "To teach her a lesson," and despite her explanations, she was fined $10.

Another prolific source of revenue is the innocent-looking white line painted down the center of the road. It is one of a neat little bag of tricks prepared for "foreign" motorists by those who have found it profitable to establish a bogus "boulevard" on a short stretch of road running through a village.

A well-known Detroit business man who knows the roads like a book, was driving through a Wisconsin town when, in passing a three-ton truck ahead, he swerved so that his outer wheels passed six inches to the left of the white line in the center of the road. In a flash a speed cop was upon him. A few minutes later he protested to the judge that when he passed the truck there was no sign of a car approaching in the opposite direction; also that it would have been impossible to pass the truck at all without going to the left of the line. He might just as well have saved his breath. The trap had him hooked.

Another common snare is the "stop" sign erected at a certain spot along the "boulevard" in such a position that it is almost invisible to passing drivers. One such sign, placed on a detour near an Ohio town last year, resulted in the hauling-in of so many motorists that at last they rose in their wrath and compelled the authorities not only to remove the sign, but to refund their fines as well.

Deceptive, too, are the will-o'-the-wisp traffic signal lights often installed at points where there is no congestion and no danger whatsoever. Last month a friend of mine ran afoul of one of these lights near a town in Pennsylvania. It was installed so high above the road that only a star-gazing driver would see it. The signal was operated by a traffic cop in plain clothes who stood, half concealed, behind a telegraph pole by the roadside.

UNBELIEVABLE as it may seem, some speed cops are not satisfied with catching you in the traps they set. They actually egg you on to break the law. Some time ago a town not far from Hartford, Conn., employed a constable who was a rip-roaring speed king. He drove a classy high powered roadster, painted brilliant red, and his chief delight was to challenge passing motorists to a race. He would roll lazily along a straight

stretch of highway until a speedy looking job came along. Then he would step on the gas, pull up alongside, and try to pass. Quite naturally the unsuspecting driver, if he was at all proud of his car's performance, would deny him the privilege, and the two would go roaring down the road side by side. At the end of the straightaway the cop would calmly inform his rival that he was pinched for speeding!

This cop made a small fortune in fees. But he overdid a good thing. Not content with matching speed with outsiders who passed through, he began to pick his victims from among his own townsfolk. He also began to try his luck beyond the town limits where his commission did not extend. The result was that irate citizens banded together and threw him out of his lucrative job.

The profits which constables and magistrates are able to rake in through the fee system of enforcing traffic regulations and collecting fines often are surprising. For instance, I know of an executive of a New York life insurance company who recently wrote to an old salesman friend, offering him a lucrative job in his office. In reply the friend wrote:

"Thanks very kindly, old man, but I now have a job as a motorcycle cop on the county boulevard, and can't afford to accept your offer."

FROM North Carolina comes a report of a father and his sons who are in the business of fining motorists and who have found it so profitable that they have hired men to work their farm while they hold up the law. In a certain Long Island town, until recently, there was a motor cop who arrested so many drivers the judge couldn't handle them all. In this case the merchants, finding that motorists were avoiding their town, forced the dismissal of the overzealous officer.

Again, the records of a certain township in Ohio show that the squire operating a notorious roadside court collected $3,506 in forty days. The squire's share of this was $1,604, while the three constables operating out of his office divided $1,096. All that was left as the county's share of the collections was $806.

In addition to their fees, which represent generous slices of fines and court costs, some speed cops have a rich source of revenue in blood money paid on the road. Many a motorist prefers to buy off his captor on the spot, rather than go through the bother of appearing in court and having his name go on the records as a traffic violator.

Perhaps you've seen it done. "Now look here, officer," the motorist will say, "I don't care so much about the money, but I'm mighty anxious to be on my way. I'd like to stake you to a box of cigars, but of course I don't know what brand you smoke. Suppose you take this and buy them yourself." And he hands the cop ten or fifteen dollars. If it works, the motorist drives on with the feeling that he has made the best of a bad bargain.

Have You Been There, Too?

Have you ever been arrested while driving your car? If so, write and tell us of your experience. What was your "offense" and what was the outcome?

POPULAR SCIENCE MONTHLY *will pay five dollars for every letter that is published. Address The Motor Editor, Popular Science Monthly, 250 Fourth Avenue, New York City.*

SURPRISING as are the profits of roadside holdup men, they are no more astonishing than is the ignorance of some who dispense all roadside justice. It is a fact that in some small villages are squires who not only know nothing of the law under which they condemn offenders, but actually cannot read legal English. Not long ago a Washington business man was arrested in a small Virginia town. When he asked the justice of the peace what the charge was, his honor fumbled with his spectacles and made a number of unsuccessful attempts to read the clauses of the motor law. Finally, a village loafer who was sitting on a cracker barrel in the store where court was in session offered to try his luck. The lout floundered for a while through the legal wording, until the squire, growing impatient, determined to wind-up the proceedings. He fined the motorist $10.25 for violation of "pages 17 and 18 of the Motor Vehicle Act!" All that the motorist had to show for the experience was a slip of paper to the effect that he had paid $10.25 for something which the justice of the peace termed "colladeral!"

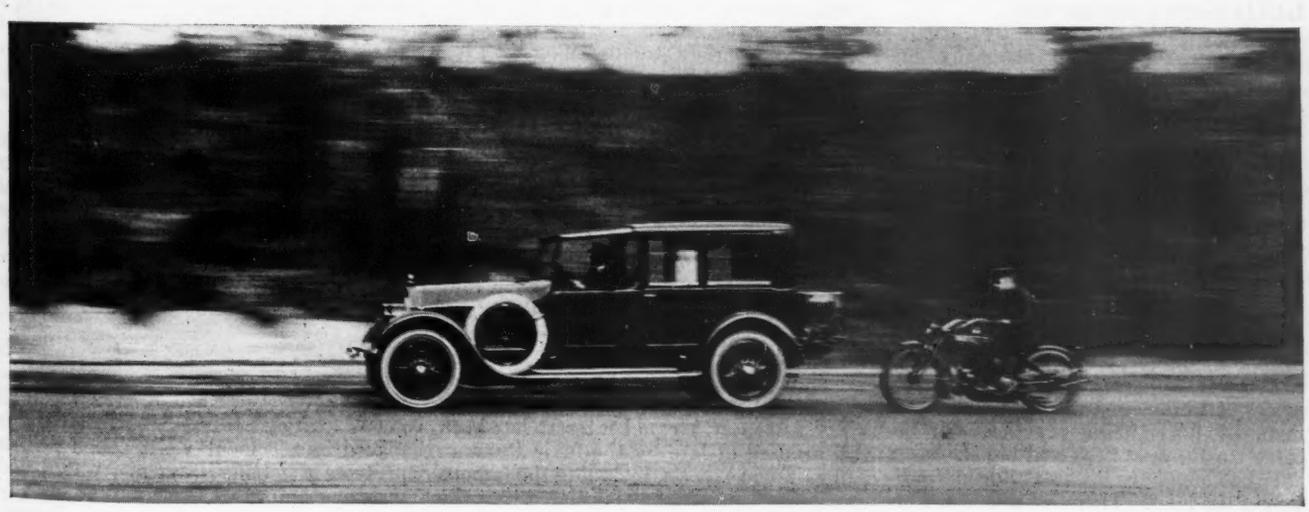
That it is possible to make such a farce out of motor laws and regulations is due first of all, experts agree, to the bewildering diversity of the laws themselves. Every state, city and town in the nation has its own pet rules of the road. During last year alone, more than 2500 new traffic bills were introduced in state legislatures, and the number which were made into laws averaged about a dozen for each state. For the motorist to attempt to be wise to them all is out of the question.

It is this enforced ignorance that makes you easy prey for the speed cop who is out to collect. In the matter of speed alone he has the drop on you. Countless towns are still back in horse and carriage days, when anything above eight or ten miles an hour was dangerous.

One effort to remedy the situation is found in the recent efforts of the National Conference on Street and Highway Safety, under the direction of Secretary Hoover, to formulate a national uniform traffic code to be adopted by the legislatures of all the states. A definite step toward the same end was taken in California a few months ago when ten of the most important towns in the vicinity of Los Angeles joined in adopting uniform traffic rules for virtually the whole southern part of the state.

IN THEIR crusade to halt wholesale extortion practiced by official highwaymen, automobile clubs and similar organizations have posted warnings of speed traps, exposed and blacklisted towns which profit at the motorists' expense, and prosecuted officials who go beyond their authority or who collect fines illegally. Many a town has learned to its sorrow that what it has gained in ready cash from autoists has been more than offset by loss of business and prestige, when traffic, heeding the warning of "speed traps ahead," carefully detours and goes around the other way.

State authorities, too, have taken a hand in protecting (*Continued on page 133*)



A Guardian of the Law Trailing an Unsuspecting Victim

When the motorcycle cop comes up behind you nowadays, you never can be sure what he's going to charge you with. Maybe you're breaking the "village" speed limit of ten miles an hour, or didn't see a cleverly hidden signal. Whatever it is, you may as well save time and plead guilty at once

SANCTIFIED MAGIC

How fakirs walk upon knives, transmit thought, pierce themselves with daggers and are buried alive, to prove secrets of control over flesh that amaze doctors

By G. B. SEYBOLD

The Fakir, Rahman Bey

Whose visit to America has revived interest in one of the most mysterious religious cults known in the world

The Bey, lying on a bed of sharp-pointed spikes to demonstrate that the control of the mind over the body can give immunity to pain

A MAN'S rigid body is suspended in the air between two scythelike swords. The cutting edge of one supports his feet and that of the other pillows his neck. Yet with his entire weight on them, these ugly knives do not cut him.

Two men place upon the abdomen of the bared body a three-foot slab of stone. A third swings a heavy sledge hammer. With a crash, the stone slab cracks and falls in pieces to the ground.

Still the rigid form, unbent by the blow, lies across the knives, magically unharmed. Now they lift it from the rack and stand it upright. It moves and is a living man!

The man is Rahman Bey, the Fakir. One of those mysterious Oriental wonder workers, whose "miracles" have been a riddle of the world for centuries, he has come to America to revive the New World's interest in Eastern mysticism.

He lies and walks upon knives, pierces his flesh with daggers and pins, casts himself into deathly trances, permits himself to be buried alive, and performs amazing feats of hypnotism and telepathy. He professes to demonstrate that the will of man, by unremitting practice, can become master over flesh and blood.

Fakirs long have been an alluring tradition of the East. Travelers in India, Persia and Egypt have come upon them wandering about the country, often clad in rags, casting bewildering spells of magic. Many a tourist has brought back weird tales of the roving ascetics who transform themselves into human pincushions, apparently without suffering, and who seem to grow palm trees from seeds in a few minutes. Others of the cult apparently cause living beings to vanish in the clouds and say they can rise from airless tombs, months after burial alive, and live again.

For the most part, little has been known of these fakirs save that they belong to a secret order, centuries old, and that they live like monks in isolated monasteries where they learn their mystical practices from childhood, through rigorous training. In recent months, however, emissaries of the order invaded the Western world. In Rome, Paris and London they thrilled audiences by their seemingly miraculous feats. European doctors who witnessed the demonstrations reported that they could discover no trickery.

IN AMERICA equal interest has been aroused of late by the fakir Rahman Bey. Some experts, including the famous magician Houdini, have declared that the Bey's feats are little more than clever tricks in a setting of Oriental mystery. Others, including medical men, have shown interest in his apparent power to control bodily processes, such as the flow of blood, and to throw himself and others into a sort of hypnotic trance.

In the presence of a group of doctors, for instance, Rahman Bey has deliberately regulated his pulse so that the count in the right wrist was ninety, while that in the left was forty-two. Two physicians made the count.

It is in their power of inducing suspended animation, however, that the most spectacular feats seem to occur. With the avowed purpose of taking a vacation from the physical world, fakirs enter trances and are buried alive, sometimes for a few minutes, and, according to reports, sometimes for days and even years. From India comes the account of a fakir who entered a trance in 1899 and remained buried until last year, when he was exhumed and brought back to consciousness. Except for weakness, the man is said to have suffered no ill effects from his long sojourn under the sod.

From India, too, comes the story of the burial of twelve fakirs who, in dread of a powerful member of their order, agreed to remain in a trance under the ground for five years. It was their hope that before the end of that period their enemy, an old man, might die.

The sudden disappearance of the twelve, however, so enraged the old fakir that he searched for the secret burial places. Two of the interred men were found and killed. The remaining ten escaped detection, and after five years were dug up and revived. In the meantime their aged enemy had died.

WHEN a burial of long duration is to be indulged in, we are told, the fakir is placed in a coffin from which all air is excluded. The coffin, in turn, is placed in a cement vault which further protects the body from air, water, and prowling animals. Once a year, usually on a feast day, the fakir's pupils inspect the grave.

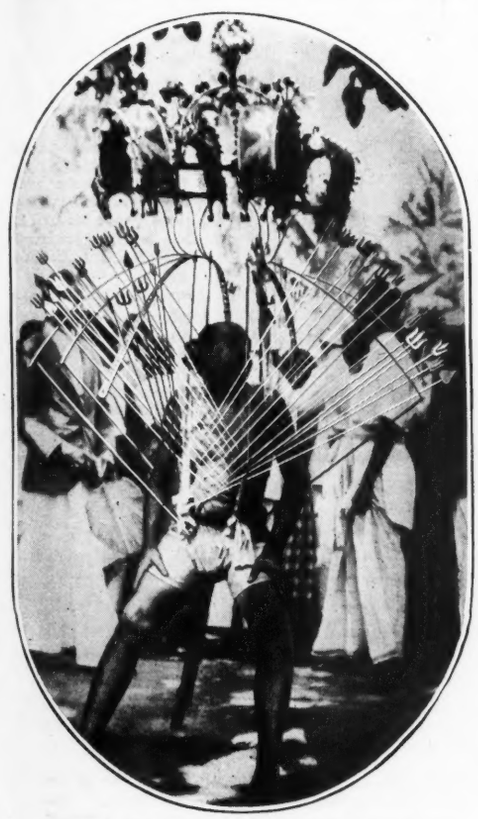
Reports of such long burials, however,

are rare. In most cases interment has been for a few days at the most. Seven days is the longest time that Rahman Bey claims to have remained "dead"—a performance staged in Alexandria a year ago. Lying in a trance for months at a time, he explains, so weakens the body of the man who does it that he cannot expect to live long after he "comes to life." On the other hand, he declares, brief periods of burial—say once a month—improve the health by giving the body a complete rest.

In his American performances Rahman Bey ordinarily remains buried alive for only a few minutes. He does, however, offer to stay in the coffin as long as his audience desires. Usually the time selected is from ten to thirty minutes. Two stipulations the fakir invariably insists upon—that he must know beforehand exactly how long he is to remain unconscious, and that he must be disinterred exactly at the end of that time. If he should be left buried even a minute too long, he warns his uneasy audience, he might die from suffocation.

THE burial is picturesque. Clad in flowing white, his head shrouded and his feet encased in sandals, the fakir appears beside the coffin—a solid looking box resting on a solid floor. For a brief time he manipulates certain nerves in his neck and at his temples. Suddenly he becomes rigid, topples over, and is caught by attendants who place him in the coffin. They cover the coffin completely with damp sand, and there he remains for the time agreed upon.

Much the same apparent control over the normal processes of the body is evidenced in the fakir's somewhat horrifying but bloodless feats of torture, of which the rock-breaking stunt already described is an example. Without a twinge he thrusts long steel needles through his cheeks and through his arms, legs and chest. He plunges a long knife through the skin of his throat, and invites physicians in his audience to stick needles into his arms. In certain wounds he apparently starts and stops the flow of blood at will. Other wounds do not bleed at all.



The Start of a Terrible Journey

Another member of the Singapore "torture club" carried a cage fitted with fifty spears, each needle-sharp point piercing him every time he made a move

AGAIN, the fakir lies with his bared back upon a board covered with sharp steel points. To make the ordeal the more impressive, an assistant stands upon his chest to force the flesh down upon the points. Rising, the fakir exhibits the wounds, which do not bleed, and within a few minutes all that is left of the abrasions are a few small red spots. In India, he explains nonchalantly, fakirs often lie on spikes for days at a time!

Now a torch is brought forth, and to the horror of the audience the fakir thrusts one arm into the flame and holds it there, while his face shows no sign of discomfort.

Finally, to demonstrate that he can exercise this strange control over others as well as himself, he hypnotizes a subject. In a trance the subject likewise undergoes the ordeal of having a stone slab broken over his body while supported only by knife edges.

It is in this extraordinary mastery of hypnotism, by which the fakirs apparently exert their will over entire audiences, that investigators find a possible explanation of some of the strangest stories of magic that have come from India. Of these the most mystifying is the famous rope trick, reported by high British officials, army officers and scientists who claim to have been eye witnesses.

IN THE center of a wide ring of spectators the fakir, dressed in the tattered garb of a mendicant, and his assistant, a scantily clad boy, sit with crossed legs on mats spread on the cobblestone pavement. The fakir produces a ball of rope. Holding the free end with one hand, he throws the ball straight up in the air with the other. The ball unwinds and the rope remains suspended in the air. Then, at the command of the fakir, the boy climbs the rope, hand over hand, and at last—vanishes.

While the astounded spectators gaze skyward, the fakir sternly commands the boy to return at once. There is no response. Apparently enraged over the lad's disobedience, the fakir seizes a knife, climbs the rope and disappears also. All is silence. Then, apparently from a great height, comes a bloodcurdling cry. A few seconds later the spectators are horrified to see the dissevered and bloody arms, legs, head and trunk of the boy drop to the ground. The fakir now descends the rope, and as the angry spectators rush toward him, he quickly gathers the dismembered parts of the boy's body, puts them together and covers them with a cloth. After a few incantations he removes the cloth, disclosing the boy, apparently as sound as ever, sitting with crossed legs upon his mat, a smile upon his dirty face.

The Singapore "Torture Club"

To insure happiness in the hereafter, Hindu fanatics devise excruciating torments for themselves. The man above undertook a three-mile walk under a blazing sun on shoes studded with nails driven points upward. Bowls were hung from hooks imbedded in the flesh

This performance, defying all known natural laws, baffled all who attempted to explain it until an American newspaper man, so the story goes, cleverly peered behind the mystery. Armed with a snapshot camera, he joined the crowd of spectators, and during the most exciting moments made a number of exposures. While his own eyes seemed to see all that the other spectators saw, the cold eye of the camera registered something far different. Instead of rope climbing and falling limbs, every one of the negatives showed the fakir and his assistant serenely sitting on their mats throughout the entire performance.

LATER the camera test was applied to other fakir mysteries, with similar results. For example, the growth of a palm tree within a few moments after a fakir apparently had planted the seed between the paving stones of a public square was found to be entirely invisible on photographs taken during the performance. In many demonstrations of this famous trick, witnesses reported that they saw the tree clearly, although it impressed them as being unreal.

The answer, as suggested by a number of psychologists, is that such magical spectacles really are only illusions created in the imaginations of spectators by the hypnotic power of the fakir. Through years of strenuous discipline, the fakir has trained his (*Continued on page 132*)

On Top *in the* April Contest

Second Prize

Confined to his home by illness, Walter A. Bollinger of St. Paul, Minn., found much entertainment in searching for the mistakes of John and Mary. Mr. Bollinger is a furniture salesman, forty-seven years old. He wins the second prize, $100 cash

First Prize

When Alfred T. Renfro of Bellevue, Wash., first saw the April Contest Picture showing John sharpening the lawn mower, he thought he would not enter the competition, because he knew nothing of mowers or their care. On second thought, however, he decided it would not be sportsmanlike to give up for that reason. So he set out to learn everything possible about them, interviewing mower sharpeners and consulting back numbers of POPULAR SCIENCE MONTHLY. As a result, he not only wins the first prize of $500, but now he probably can lay claim to know more about mowers than anyone else in his town. Mr. Renfro is a commercial artist

Third Prize

Maribelle and Edward, Jr., were the happiest members of the family of Edward H. Samen of La Salle, Ill., when they learned that the judges had awarded him the third prize of $50. Mr. Samen is an automobile repair man, whose hobby is experimenting

Meet Some of the Other Leading Contestants

Mrs. Eva M. Saunders of Bolivar, N. Y., submitted her answers in the form of humorous rhymes. "The dog certainly gave me a heap of trouble," she writes

"The prize made a pleasing graduation present," writes Robert McCarthy, eighteen (right), who has just finished a high school course at Oil City, Pa.

James A. Gibson, age 14 (left), drew another sort of prize from the water near his home in Victoria, B. C. It's an 18¼-pound salmon. James is shown here with his brother

"My husband and our seven-year-old son, Jack, aided me with many valuable suggestions," says Mrs. H. S. Ringland, a writer, of Islington, Ont., Canada

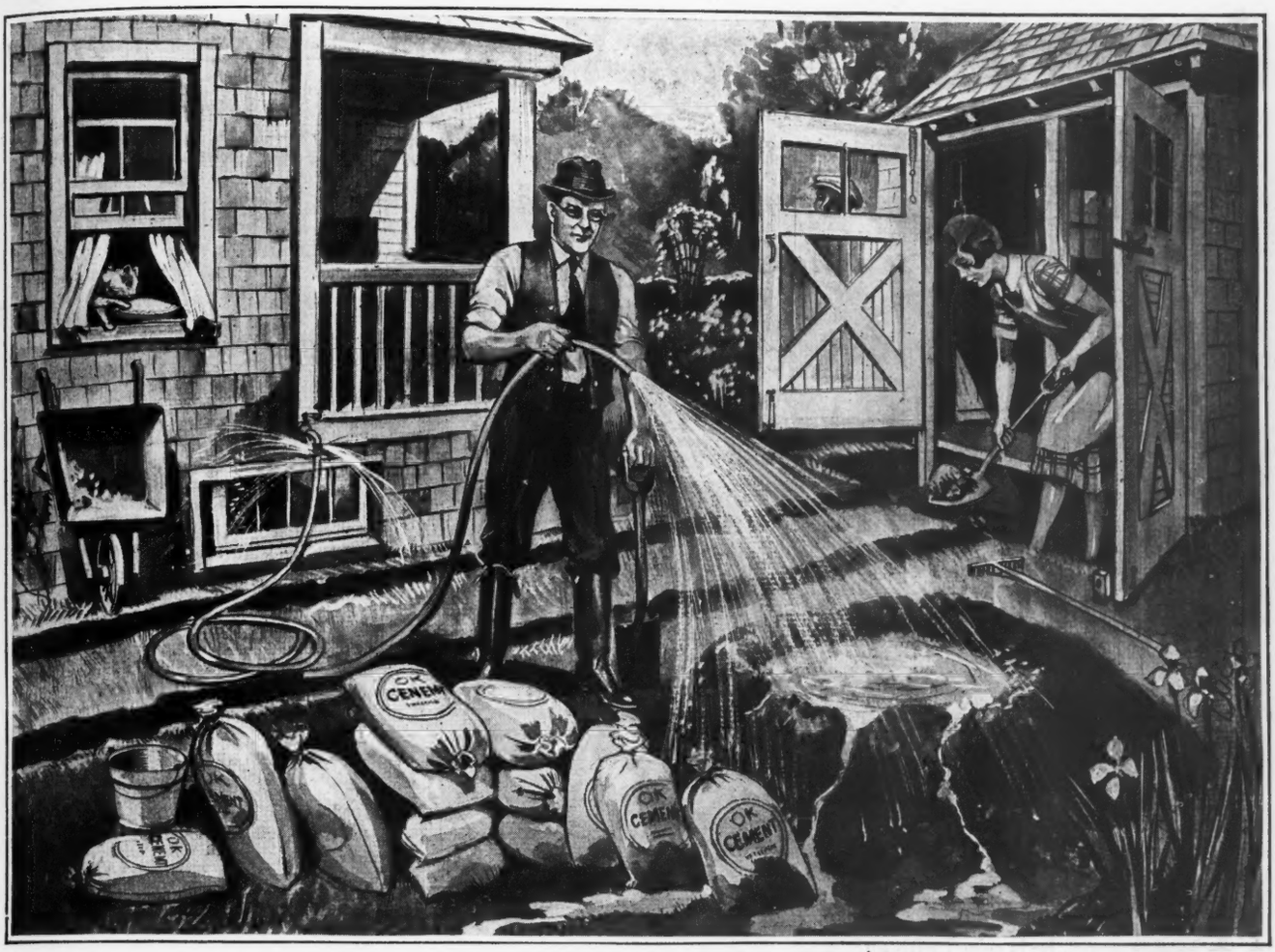
"Each Contest Picture offers a hundred riddles and challenges," writes F. L. Rohrbach (left), an electrical engineer of Spokane, Wash. Photo shows him with his two children

Herbert T. Potter of Leonardsburg, Ohio, and one of his children. He is a rural mail carrier. Working on the contest helped to forget his troubles while laid up with the "flu"

The second oldest of twelve children, Leo J. Scanlon of Pittsburgh, Pa., writes to tell us he has acquired "the habit of helping others as well as myself"

T. A. Rogers of Yakima, Wash., with two of his most faithful friends, "Tut" and "Sport." An engineer and inventor, he is using his prize money for his experiments with internal combustion motors

TURN TO PAGE 137 FOR THE COMPLETE LIST OF PRIZE WINNERS FOR APRIL



John and Mary Newlywed decide to build concrete runways to their garage. They buy the cement and enthusiastically begin the job. What are they doing wrong, and why is it wrong? What mistakes has the artist made in drawing the picture? Write down as many errors as you can find and compare your results with those of one of your family or your friends. Another interesting picture will appear next month

What's Wrong *in This* Picture?

The Newlyweds Are with Us Again in a Fascinating Game

"WE COUNT John and Mary Newlywed among our best friends," a reader of POPULAR SCIENCE MONTHLY wrote recently. "My wife and I have just started housekeeping and already we have saved ourselves many a laughable mistake by figuring out the errors of this young couple. The 'What's Wrong' pictures have been the most helpful I ever have seen."

Hundreds of others have expressed their appreciation of the series of John and Mary pictures that have appeared from month to month. Finding errors of the Newlyweds, they say, has increased their power of observation, aroused their ingenuity, and added to their useful knowledge. Everything from seed catalogues to Shakespeare has been scanned for clues; and, judging from the letters, those who have been successful have developed into the world's most alert questioners.

Although the series of Prize Contest Pictures has been completed, so many of our readers have found pleasure and profit in them that we plan to continue publishing the John and Mary picture puzzles, but without offering prizes for the best solutions. In following the further adventures of John and Mary in home-making, beginning with this issue, you will find that the search for their errors is a fascinating game. Moreover, you'll be surprised how it will sharpen your powers of observation and add to your knowledge.

In this month's picture the energetic couple are working on a drive for their garage.

The cement came the other day and John piled it close to the house. Here you see John getting to work with a will, mixing the concrete. Mary has worked enough in her garden to know how to handle a spade. She is helping prepare the bed for the runways.

They are having a grand time, both of them; yet in their enthusiasm they are making a number of serious mistakes. Then, too, the artist has made certain errors in drawing the picture. How many mistakes of all kinds can you find? List the mistakes on a piece of paper. Then compare your results with those of a relative or friend. See which one of you can display the keenest observation and widest knowledge. There'll be another picture next month.

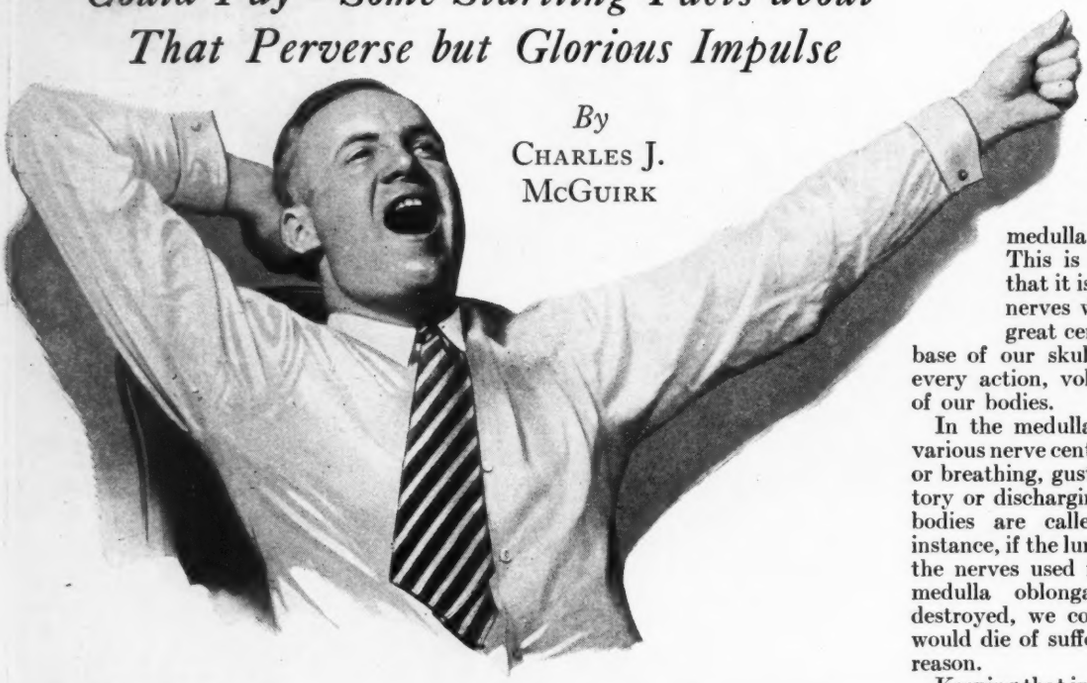
Look for Your Name Next Month

THE judges are now busy completing the prize awards for the May Picture Contest. The complete list of winners in this contest will appear in our October issue. You'll want to see if your name is among them.

The October number, by the way, will be packed full of fascinating features, including another installment of Archibald Douglas Turnbull's great serial story of Benjamin Franklin; more of Sam Loyd's famous brain twisters; more of the wonder stories of science; and many other useful articles.

If People *Yawn* When You *Talk*

It May Be the Sincerest Compliment They Could Pay—Some Startling Facts about That Perverse but Glorious Impulse



By
CHARLES J. McGUIRK

A BRAND-NEW baby yawns.

Lying there, a tiny mite in a roaring world, he is seized with an impulse. Anxious watchers see his face screw into a knot and the lids of his tight-closed eyes draw even tighter together. He sucks in a breath that you can hear. As his rosebud mouth starts to open mightily, his little hands close to form fists; his chest raises; his fists stretch out and his body twists while his head pushes back. Tears squeeze from between his eyelids and his mouth becomes moist.

"Yow! Grrump!" he remarks as his fond father grins.

That yawn is one of the first grand and glorious feelings he experiences. Oftentimes, also, it is his first meal, a big mouthful of that cheapest and most priceless necessity of life—air.

"Well, what of it?" say you. "Everybody yawns. Never saw anybody that couldn't and didn't—often. Nothing in a yawn to get excited about."

And that is what I thought until one day a nurse told me that frequently it was a symptom, looked for and recognized as such by physicians and surgeons, of various "pathological conditions." So I went on the trail of the omnipresent yawn, and in the course of my investigation came upon Dr. Clay Ray Murray, associate attending surgeon at the Lincoln Hospital, New York City, and Dr. Frederic Damrau, neurologist, of Brooklyn. Both of these men supplied me with startling facts concerning that complicated muscular movement—the yawn.

Yawning is an involuntary act. You can no more stop one than you can jump over Niagara Falls. It can be caused by any number of things. We yawn when we are bored, but we yawn when we are excited, too; we yawn when we are sleepy and when we've had too much sleep; when we are enjoying the best of health, or when we are sick, or about to be. And, strangest of all, we may yawn when we are about to die.

Anything will start a yawn. An earnest, monotonous talker; seeing somebody else do it; excessive nervousness; love; too much concentrated attention or not enough of it.

Underneath all of these things, which the doctors term "incoming sensory impulses," the primary purpose of the yawn is to supply the imperative demands of our bodies for "more air and hurry up about it!"

THE yawn itself is really an intensification of breathing. Its mechanics are the same as that of normal respiration. The same muscles are called into play, but their movements are more extended. Every muscle that is called into play, either directly or indirectly in the expansion of the chest (which is inhaling) and all the muscles used in exhaling are utilized. But in the fully developed yawn there is action also in the muscles of the face, the depressors of the lower jaw, the dilators of the nostrils and upper lip, the muscles governing the larynx, the palate, the back muscles of the throat and, when a stretch follows it, of every muscle in the body.

He suddenly yawns—at the climax of your sales talk. Was it boredom? Perhaps it was. But it may have been a sign of the keenest interest, too, doctors say

The doctors say that a yawn follows a neurological pattern and is governed through the medulla oblongata or small brain. This is another way of saying that it is a reflex action of the nerves which is directed by the great central switchboard at the base of our skull which takes care of every action, voluntary or involuntary, of our bodies.

In the medulla oblongata are all the various nerve centers, such as respiratory, or breathing, gustatory, or eating, excretory or discharging, everything that our bodies are called upon to do. For instance, if the lungs were kept intact and the nerves used for telegraphing to the medulla oblongata were severed or destroyed, we couldn't breathe and we would die of suffocation for no apparent reason.

Keeping that in mind, you will get some idea of the neurological pattern of a yawn.

FIRST, you have your incoming sensory impulse, which may be caused by seeing someone else yawning or by meeting one of those earnest, long-winded talkers. Or the blood may be deficient in oxygen and is telegraphing for "more air." Or we may be mentally or physically tired.

Whatever it is, the message is carried instantly to the "respiratory central" in the nerve center. The respiratory central "plugs in." "Breathe deep" she telegraphs through the vagus nerve. We start the deep breath. "Eat" she orders, and we get an overwhelming impulse to open our mouths, while an increased flow of saliva is started. "Deeper," she orders the chest muscles, and the air sucks into our lungs as space is made for them by the expanded chest. "Reach out!" she insists, and our shoulder and arm muscles obey. "You, too!" she orders the legs. And the first thing we know, we are in one long, luxurious yawning stretch, with every muscle taut and pulling one against the other.

Oxygen pours into the lungs. The blood takes it up and rushes it along through the venous system. We are

literally "purified and cleansed," new men and new women ready to stand and stand for anything.

The yawn is a wonderful balancer, and there is no doubt it does much to keep us comfortable under trying conditions.

You have probably noticed that when you are in a crowded subway car or a room insufficiently aerated, you yawn. Now you know the reason. It is an instant answer to any retardation of the breathing or to any influence which tends to cut down the necessary oxygen in the blood.

A MAN sits in a poker game where the "sky is the limit." He plays along with indifferent luck until there comes a moment. Picking up his five cards, he beholds a straight flush, one of the game's highest hands. Being an experienced player, he refrains from rising and giving three rousing cheers. Instead, he sits very quietly and waits for someone to "open." He gets his wish because Fortune, being a woman, has become tired of monotony and craves action. To three other players she has given hands worthy of not only the deepest appreciation but the warmest support.

Somebody bets. He raises. It comes around to him again; he raises again. The pile of chips in the center grows bigger and bigger. Everybody is betting and raising, betting and raising again. An onlooker, knowing what our friend holds, is amazed at his control. Not by the quiver of an eyelash does he betray the dynamite with which he is going to demolish the other three and rake in the pot.

AND the onlooker's admiration is raised to the nth power when suddenly our friend of the straight flush throws back his head—and yawns!

"Say, you're a poker face, I'll tell the world!" the onlooker compliments him, as he pulls in the pot. And he admits it. He really thinks he is. But he could no more have kept from yawning than he could have flown.

Here is what happened. He picked up his cards and saw the straight flush. His heart, after missing a beat, went to work at increased speed. He was in the grip of excitement. Normally, he should have done just what he didn't do, given three cheers. Instead, he kept on the mask of indifference. Under the mask, excitement began to burn him up. And suddenly, he didn't have much oxygen left.

And when *she* yawns—just when you are nerving yourself for the big moment—it is a ten to one bet it's because her heart has been pounding at an unaccustomed speed, too

"Oxygen. Lots of it in a hurry!" telegraphed the heart to the medulla oblongata. Result, the yawn.

A shy young man goes courting the girl who in his dreams he pictures as his wife. He finds her in the porch swing with mother and father mysteriously absent, and he nervously takes his place beside her at her invitation.

The air is heavy with the breath of roses and growing things. He hears the insects whispering. A big frog "jug o' rums" somewhere along the river.

He wants to take her hand. Awfully. Just to hold her hand a minute. They talk. If he could just reach out his finger, accidentally, of course, and manage to brush the hand close beside him—He starts, loses his nerve, and gulps. They talk some more. He girds himself to a supreme effort. He reaches out and—she moves the hand to hide her mouth, which has opened in an involuntary yawn.

Why We Yawn

"ANYTHING will start a yawn. An earnest, monotonous talker; seeing somebody else do it; excessive nervousness; love; too much concentrated attention or not enough of it.

"We yawn when we are bored, but we yawn when we are excited, too; we yawn when we are sleepy and when we've had too much sleep; when we are enjoying the best of health, or when we are sick or about to be. And strangest of all, we may yawn when we are about to die.

"Underneath all of these things, the primary purpose of the yawn is to supply the imperative demands of our bodies for 'more air and hurry up about it!' "

Dawg gone! He'll never get anywhere with her. Here she is, bored to death with him. And he says good night.

When he is safely out of hearing, she punches the cushion and has a good cry. What is the matter with Henry? And what is the matter with her? Just when she felt in her bones he was getting up nerve enough to kiss her—or hold her hand anyway—she had to go and yawn!

It was the same reason as with the lucky poker player. Excitement eating up oxygen and her heart, that is panting for her lover, sending up a cry for "more air!"

An assistant professor of economics in a small college early in the year began to entertain a hearty dislike for one of the students. This student, a boy from the farm, at the first lecture started a course of procedure the reiteration of which made the professor want to murder him. He would sit forward in his chair in an attitude of deepest attention, seemingly hanging on the prof's every word. Then, just as the lecturer was beginning to believe he had captured this particular student's imagination, the country boy's face would disappear behind a yawn.

"Poker face!" we shout, when the yawning scalawag unloads his dynamite and rakes in the pot. But he could no more have helped himself than he could fly. That yawn was one of nature's ways of relieving the grip of intense repressed excitement

The assistant professor, being young, was sensitive, and the country boy was beginning to become an obsession, when he happened to talk about him to an old doctor who was dean of the medical school. The dean laughed.

"Why," he said, "that boy is paying you the highest compliment possible. He is so interested that his brain draws on the blood for more oxygen. He *has* to yawn!"

The assistant was half convinced because he wanted to be. But when the results of the semester exams were known, the farm boy had received the highest marks. Literally, he had been drinking the subject in.

THESE instances point out the good side of yawning. Yawns also have their bad sides. And when they are bad, they are called symptoms.

When a physician is called to attend a patient suffering from an illness whose nature has not yet been determined, the patient's frequent yawns help him to diagnose the ailment.

The doctor knows that yawning frequently is the product of melancholy, languor, torpor, ennui or weakness, or of the malaise that precedes the onset of a disease.

This patient the doctor is studying may be suffering from inflammation of the pericardium, or sack containing the heart, for instance. Or his big artery, the aorta, may not be functioning properly. Certainly, the physician knows, the patient is suffering from something that is interfering with his circulation or with his breathing or something else which has induced or is inducing mental or physical exhaustion.

AS FAR back as Hippocrates, who is the patron saint of all doctors, the yawn was recognized as the precursor of a fever, particularly of malaria or intermittent fever. Hippocrates himself is said to have been able to tell from the frequency of the yawns just how bad the fever was going to be.

Then doctors got away from regarding the yawn as a symptom. But they recognize now that it is one of the symptoms preceding the coming attack of such eruptive fevers as chickenpox, smallpox, measles, scarlet fever and so on.

All in all, however, the yawn measures up as one of the nicest things that can happen to us. It certainly gives us that grand and glorious feeling.

Bridging a Celestial Abyss

IN A far-off island universe, pictured above, the light of a new star has just been discovered by the German astronomer, Max Wolf. So far distant is this star that its light, traveling 186,000 miles a second, has taken ten million years to reach us!

Only by comparison with familiar things can our minds span such a tremendous gulf of space. Suppose, for example, a highway should be bridged from the Earth to the new star, and we should cross it in an automobile at the speed of light. We would pass the planet Saturn in just one minute; Neptune, in two minutes. In 190 years we should arrive at the great star Betelguese. Yet the trip to the new star would take us ten million years.

Distances That Stagger Human Imagination

Again, suppose we place our Sun on the site of the Washington Monument and reduce its diameter to equal the height of the monument. If, on the same scale, as pictured at the left, we lay our planets on the map according to their distances from the Sun, Neptune, the outermost planet, falls near Springfield, Mass. To map the new star on the same reduced scale would be impossible, for it would fall more than 700 billion miles away!

Millions of years before the first glacial periods on earth, the celestial explosion occurred which started the light of the new star upon its journey through space. It has just reached us. Compared with this great abyss of time, the little 5,000-year interval of authentic history on earth, indicated by the width of the line at the extreme right of the sketch above, is but the flick of an eyelash. The past ages shown here equal only one tenth of the time it has taken the new star's light to reach us!

What Oil Burner Shall I Buy?

An impartial expert answers a question thousands are asking—What you may expect from the various types of burners—Factors that should determine your choice

By P. E. FANSLER

"WHAT is the best oil burner?" People have asked me this question more frequently, perhaps, than any other. Scores of letters are received daily by the Popular Science Institute of Standards asking: "What burner shall I buy? Tell me what is the best burner!"

There is no "best" oil burner. Many satisfactory makes are now on the market, any one of which will give you complete heating comfort in your own home. Each has its own particular advantages and features. But before you can make an intelligent choice, it is necessary for you to get clearly in mind some of the basic principles of oil burner operation.

In the first place, no oil burner actually burns oil. An oil burner is simply a gas making machine for the conversion of fluid oil to a gas that will burn properly when mixed with air. And the only difference between the various makes of oil burners is in the way they accomplish the same desired result.

Oil burners for use in home heating may be divided roughly into two major classes. There are atmospheric, or so-called "gravity" burners, and mechanical draft burners. An atmospheric burner of the highest grade can be purchased at prices up to about $300; while the mechanical draft type of burner costs from around $350 to $1500, depending on the capacity of the burner and the size of the storage tank and the other refinements and conveniences.

Satisfactory home heating is possible with the better grades of atmospheric burners, but you must have a mechanical draft type of burner if you want the greatest possible comfort from your burner, because only with the latter type is it possible to eliminate the need for constant adjustment and periodic shutdowns to clean out the soot.

THE greatest advantage of using oil to heat your home lies in the fact that the heat is turned on and off automatically so that the house is always kept within a degree or two of the desired temperature no matter how the weather changes outdoors.

In all types of mechanical draft oil burners, this automatic control is accomplished electrically. The illustration on the next page shows a simple arrangement that is, of course, varied in detail to suit the particular type of oil burner. Upstairs on the main floor there is a delicate thermostat that goes into action the minute the temperature in the house gets colder than desired.

If, for instance, the room cools off to sixty-nine degrees while the control is set for seventy degrees, the thermostat immediately closes an electric contact that starts up the oil burner in the cellar. The mixture of air and finely divided furnace oil is fed into the heating plant, where it is ignited by the gas pilot flame or the electric spark, and in a few seconds the oil burner is generating heat at full blast. Shortly thereafter the radiators in your home begin to raise the temperature, and when it reaches seventy-one degrees the thermostat cuts the electric circuit to stop the mechanism once more, and the burner stands by until the next call for heat is transmitted to it from the thermostat.

From Fall To Spring—Heating Comfort

The oil burner automatically keeps the house at the same temperature from the time you turn it on in the fall until you shut it down in the spring

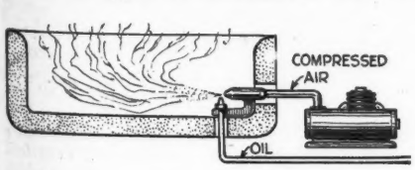
THREE methods used by various oil burners for converting the oil to gas and mixing it with air are graphically explained in the diagrams at the bottom of this page. Fig. 1 shows a simple design for a mechanical draft type of oil burner. In burners of this type the jet of air blown across the end of a small pipe connected with the oil supply creates a suction that draws oil out of the pipe and breaks it up into small particles. It is the familiar perfume atomizer designed on a large scale to do to the oil what the tiny atomizer does to the perfume. The same principle in one form or another is used in practically all types of automobile carburetors.

A variation of this principle used in some oil burners is the Venturi tube idea. The air is passed through a double tapered tube at high speed, and the oil is sucked out of a small hole in the wall of the tube at the smallest point.

But this is only one of the methods used in breaking up the oil into fine particles and mixing it with air. Several types use horizontal rotating disks connected with the electric motor that operates the blower. The oil is fed slowly onto the center of this rapidly spinning disk and is thrown off the edges by centrifugal force in the form of tiny drops. At this point it encounters a blast of air that is rising around the disk.

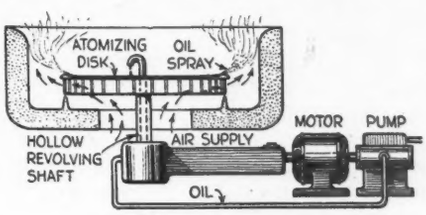
A SIMPLIFIED drawing of a burner built along these lines is shown in Fig. 2. The shape and size of the disk is varied to suit the ideas of each manufacturer so that it will give the nearest approach to a perfect mixture under the conditions obtaining in the heating plant where it is installed. Some types of disks are made with serrated edges to help break up the oil.

All oil burners of the mechanical type use a draft of air produced by a blower connected to an electric motor, but some



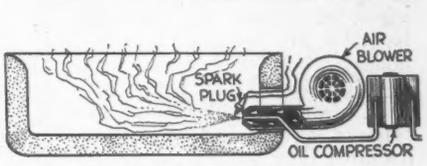
Like a Perfume Atomizer

Fig. 1. One way of breaking up oil. Two other methods used are shown at right



This Burner Spins the Oil

Fig. 2. Rotating at a high speed, the atomizing disk throws off the oil in fine particles



Oil and Air Under Pressure

Fig. 3. Oil spurts from a special nozzle, produces a fine spray and mixes with air column

types do not depend on the suction of the air jet to feed the oil. They are equipped with pressure oil pumps geared or belted to the same motor so that both the oil and the air are fed by positive pressure. One type forces the oil under a pressure of about 100 pounds through a special nozzle constructed so that the oil issues from the end of it in the form of a fine spray that encounters the entering column of air in the combustion chamber. Such a design is shown in the drawing of Fig. 3.

There are also variations in the methods of burning the oil-gas after it is introduced into the fire box. Some manufacturers believe that the oil should be burned in a fire pot made of special refractory material that resists the effects of heat developed by the burning oil-gas. Others line the ash pit of the boiler with fire brick in such a way that the flame touches only the bricks.

THE object of these precautions is to prevent the flame from touching the metal of the boiler. At first sight it would appear that the best way to heat anything would be to direct a flame against it. That is true if the flame is of the blue type such as is produced by a gas stove. Oil burners of most types, however, produce a luminous flame, and if this flame actually played against the relatively cold iron, the result would be the same as it is when you hold anything made of cold metal directly in the flame of a candle. Soot is deposited in large quantities, and if an oil burner were operated in this way the whole furnace would soon become clogged with soot. To heat anything with a candle, you hold the object just above the point of the flame. The same principle is used in the operation of all types of oil burners.

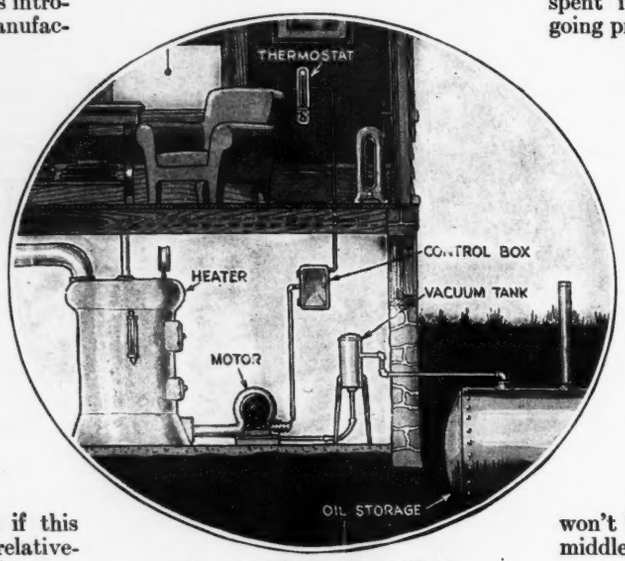
Practically all types of high grade mechanical draft oil burners require that your house be wired for electricity, because all use an electric motor of about one-quarter horsepower to operate the blower, oil pump or rotating disk. So if you haven't electric lights in your house, you are limited to an atmospheric type of burner.

SOME types of oil burners use a gas pilot to ignite the oil-gas when the thermostat turns on the current that starts the electric motor. Others use an electric spark from a special make spark plug connected to a high tension coil of the automobile type or a high tension transformer. The current to operate the ignition device is always obtained from the house wires, of course, so that no batteries are needed. If your home is wired for electricity but not piped for gas, you must eliminate from consideration all types of oil burners that can be operated only with a gas pilot flame or that use a gas pilot flame to heat a vaporizing plate. Unless, of course, you obtain a supply of bottled gas.

The question of noise is frequently discussed in connection with oil burners. But the amount of noise made by the blower motor and the roar of the flame depends entirely on the type of heating plant and the location of the burner.

As a general rule you will find that the noise produced by the burning oil flame is heard through the house to a much greater degree if the heating plant is of the hot air type than would be the case with either hot water or steam.

But most types of modern oil burners are surprisingly quiet. What noise there is usually consists of the steady hum of the electric motor plus the noise of the blower—say about the noise of an ordinary electric fan. Oil that is burning under forced draft produces a steady roaring or rushing sound that is greatly muffled by the furnace itself. The degree to which this sound is muffled depends largely upon the size and shape of the furnace. Certainly the average home owner will soon become accustomed to the slight noise produced by the modern oil burner. And at six o'clock of a freezing cold winter morning, the slight noise of a properly functioning oil burner forecasting a nice, warm house in which to dress and eat breakfast, would be a welcome sound to most of us. No time spent in a cold cellar getting the fire going properly!



How the Thermostat Works

When the temperature changes upstairs, the thermostat, usually installed in the living room, either starts or stops the oil burner in the basement, to bring the temperature to normal. This process is continuous and automatic

THE natural draft in your chimney is a vital factor in the success of any of the atmospheric type oil burners, but a good draft is essential with even the mechanical type of burner. You can't expect an oil burner to give satisfactory service when the draft is so poor from clogged and sooty pipes that even a coal fire burns sluggishly.

The matter of storage of the oil fuel must be considered in deciding on what type of oil burner to buy, because the storage system is an essential part of the installation. By all means get a large tank so that you won't be caught without oil right in the middle of a long spell of cold weather accompanied by snowstorms. The trucks that deliver oil are just as likely to get stuck in snowdrifts in winter as the coal wagon.

You should have a tank big enough to run your oil burner for at least two months without refilling.

SO MANY factors enter into the question of what oil burner to buy that it is impossible to deal specifically with details of all types of installations in an article like this. However, the officials of the Popular Science Institute of Standards have prepared a chart on which you can list the details of your own particular home heating problem. If you will fill in this chart completely, it will present to the Institute experts a mental picture of your heating plant and they will be able to give you specific advice. A copy of this chart can be obtained by writing to the Popular Science Institute of Standards, 250 Fourth Avenue, New York City.

Of course you must understand that an oil burner is not a cure-all. You cannot correct all of the deficiencies that now exist in your heating plant by putting in an oil burner. That is why it is so important for you to give us all the details of your present equipment.

This article, the second in an unusually informative series, was written by P. E. Fansler, associate editor of The Heating and Ventilating Magazine and Secretary of Public Relations of the American Society of Heating and Ventilating Engineers. The next article in this series will appear in an early issue.

Help in Selecting a Burner

THE engineers of the Popular Science Institute of Standards are ready to help you solve your oil burner problems.

The Institute has undertaken, in conjunction with The Heating and Ventilating Magazine, a nation-wide survey to determine the efficiency of the several oil burners.

This survey is the most elaborate of its kind ever made. Oil burners in homes in every part of the United States are being inspected and detailed reports are being compiled on the results of the various types.

For information about oil-burning equipment for your home, write to Popular Science Institute of Standards, 250 Fourth Avenue, New York City. A chart has just been prepared that will assist you in solving your problem. Ask for it!

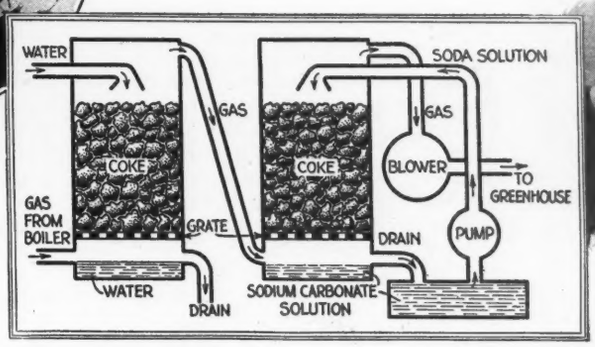
A Coal Gas Diet for Plants

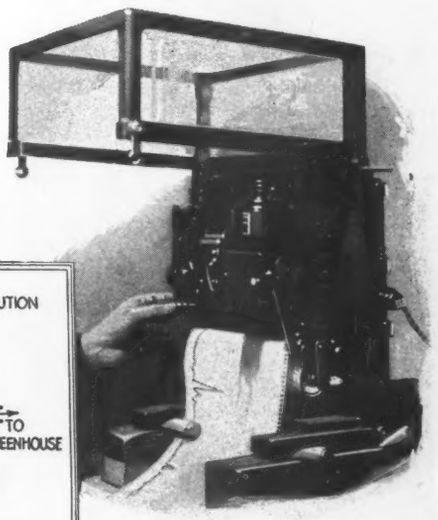
How Furnace Fumes Are Used to Produce Gardening Miracles

By Ernest Bade

Full Growth in Five Weeks

Each of these begonia plants is five weeks old. The one at the right developed normally, but the other owes its growth to carbon dioxide supplied in large amounts





How Gas Is Fed to Plants

Above, electrical device for regulating the flow of carbon dioxide to greenhouse. At left, gas "scrubbing" process

IF SOMEONE should tell you that you might run a pipe from your chimney to the back yard garden and use the coal gas from your furnace to fertilize vegetables and flowers, you probably would laugh at the idea.

Yet virtually that same thing is being done today in remarkable experiments conducted in at least two plant laboratories near New York. Plants are being made to grow and flourish as never before on a simple diet of carbon dioxide—the gas of combustion given off by the very furnaces used to warm the greenhouses in which the plants are grown!

That such things have proved possible, even experimentally, is due to comparatively recent scientific discoveries concerning the manner in which plants breathe and draw nourishment from the atmosphere, the sunshine, and the earth. It has been learned, for one thing, that plants breathe like animals. Thus a plant takes in oxygen through tiny openings in its leaves, called stomata, much as we breathe oxygen through our noses, and gives off carbon dioxide.

IT HAS been found, however, that under the influence of sunlight, the plant, while breathing oxygen, also draws in carbon dioxide, which pervades the atmosphere, and uses this gas to manufacture the starch on which its growth depends.

It is through study of this starch-making property that experimenters have been able to achieve remarkable results in increasing plant growth. They have found that by slightly increasing the quantity of carbon dioxide available to the plants, and supplying the gas in the greenhouse at certain times of the day, they can make the plants grow from two to three times as fast as they would ordinarily, and more luxuriantly. The method by which this is accomplished is really nothing more than feeding a plant through its leaves by supplying the raw materials it needs to build its structure; yet as a method of fertilization it is entirely new, and it is surprisingly inexpensive.

In the starch-making process, which goes on in the leaves, the plant calls upon the rays of the sun to work a transformation which seems almost magical. The secret lies in the wonderful properties of the green coloring matter, known as chlorophyll, which gives the leaves their hue.

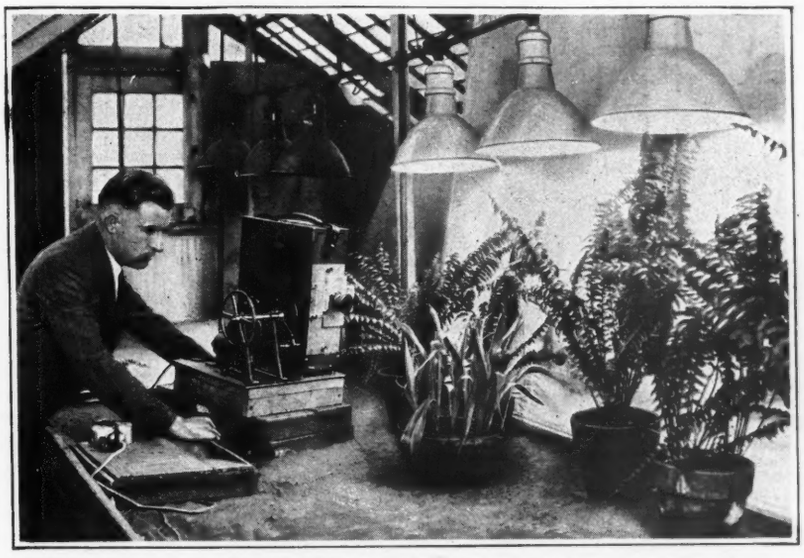
First of all, the raw materials for the production of starch are water, drawn from the earth through the plant roots, and carbon dioxide breathed from the air through the tiny leaf openings. When the water and carbon dioxide come together in the leaves, instantly the green coloring matter, stimulated by the chemical influence of sunlight, begins to perform a rapid series of chemical changes. First, carbonic acid is formed. From this is produced formic acid which, in turn, is changed into formaldehyde. Each of the last two changes creates a by-product, oxygen, which is thrown off into the air. From the formaldehyde a condensing process brings forth grape sugar; and finally, by a remarkable union of molecules, the grape sugar is turned into starch.

FOR purposes of comparison, one set of experimenters at the laboratory of a fertilizer company at Elizabeth, N. J., employ two greenhouses. In one the plants grow in ordinary atmosphere; in the other they are fed extra doses of carbon dioxide. To supply the gas to the latter, ingenious apparatus has been installed to clean and purify the gases of combustion produced in the furnace.

At the Boyce Thompson Institute, Yonkers, N. Y., recently, red clover flowers were produced, using a carbon dioxide process, one month after the seeds were planted. Normally it requires a year to produce flowers from clover seed.

The way in which the plants seem to thrive on the strange diet suggests fascinating future possibilities.

Wonders of Plant Cultivation Recorded by Movies

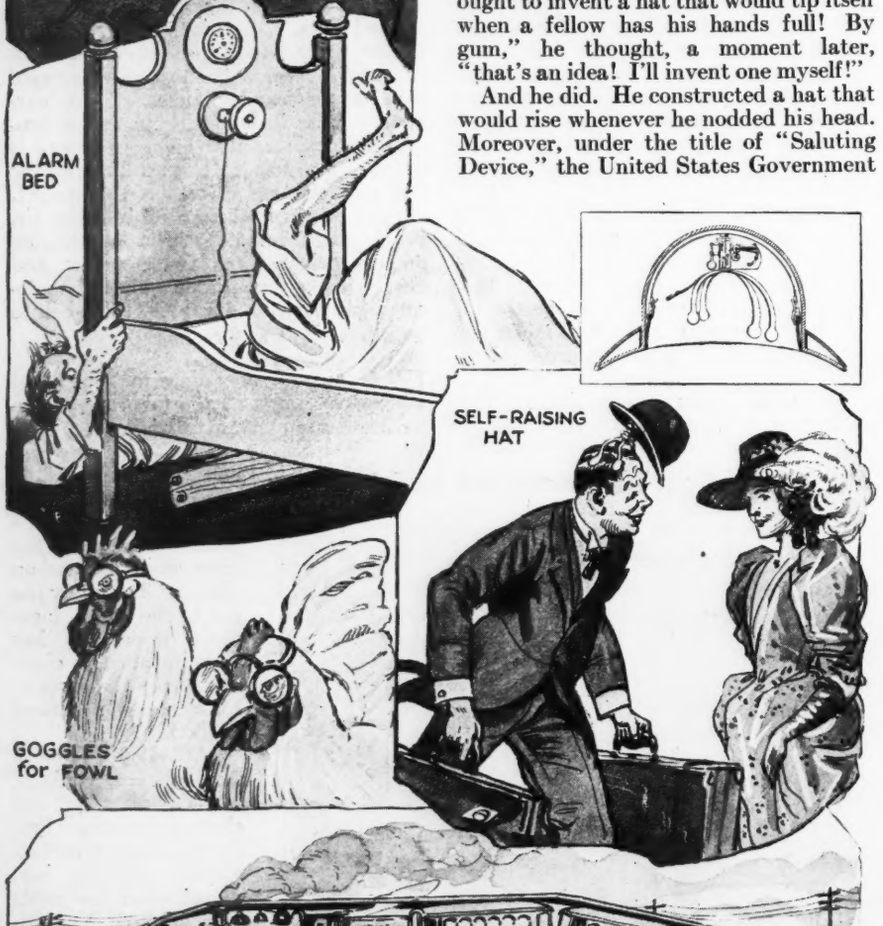


That plants can be grown on schedule and with amazing rapidity through the use of artificial light was demonstrated recently by the Westinghouse Lamp Company. Moving pictures showed some plants progressing from bud to full bloom in forty-five minutes

Curious Things

Strange Devices Exhumed from the

By EDWIN



MORE than thirty years ago a young man, starting on his summer vacation, strolled to the railroad station with a heavy suitcase in each hand. On the way he encountered many of his young women acquaintances and being a stickler for the niceties he saluted each one as a polite gentleman should—by tipping his hat.

Now, saluting in this way while struggling with a hundred pounds or so of hand baggage is no feat to be tossed off lightly. Each encounter required that the young man stop, place his bags on the sidewalk, raise his hat, and then pick up the bags again and resume his journey toward the station. He accomplished each greeting with as much good grace as could be expected under the circumstances, but by the time he was on his train, he was pretty well tired out.

"Phew!" he breathed as he seated himself. "I'm glad that's over! Somebody ought to invent a hat that would tip itself when a fellow has his hands full! By gum," he thought, a moment later, "that's an idea! I'll invent one myself!"

And he did. He constructed a hat that would rise whenever he nodded his head. Moreover, under the title of "Saluting Device," the United States Government awarded him a patent on the idea in the year of 1896.

The writer came across the patent papers of this and some other odd or fantastic conceptions of inventors while searching among the Government records recently. The details of several of the most striking ones are given on these pages, the illustrations being adapted from the original patent drawing.

Most of these inventions are not only highly ingenious, but can be made to work. Also, some of them contain suggestions of practical value; and it is particularly interesting that in almost every case the idea reflects a certain trend of invention at the time it was patented.

TAKE, for example, Patent No. 325,437, issued in 1885. It is entitled "Alarm and Waking Bed." Quite evidently it was one of the heralds of the age of the suburbanite and commuter, for it provided an effective way of getting up in time to catch the morning train. Actually it is a simple mechanism for dumping the lingering sleeper out of bed, should he ignore the alarm clock. If the sleeper does not arise, the clock at the head of the bed trips a latch supporting the head portion of the hinged bed frame, spilling the occupant on his head!

Similarly, one of many early attempts to supply the busy man with a quick-shaving safety razor may be seen in the "Shaving Device," to which was granted Patent No. 646,065 in 1900. Behind that modest title is a device that is nothing more nor less than an emery wheel for grinding the whiskers off! It consists of a small roller with an emery surface, driven from a belt connected with the wheel of a sewing machine. Let the inventor describe its operation:

"THE abrading surface of the roller," he says in his patent papers, "is held in contact with the face of the user, and the roller given a continuous rotary motion at a high rate of speed and the roller moved over the face as the beard is worn away, the device to be used on a perfectly dry face, no soap or water being used!"

As to the safety of it, only the man who has tried it can tell.

Again, one of the beginnings of the modern vogue for face lifting, permanent waves and similar beautifiers perhaps may be found in the "Device for Producing Dimples," patented in 1896. This is simply a brace and bit for wearing down a neat hollow in the flesh wherever the dimple may be desired! The business end consists of a knob that is placed on the desired spot, and an arm with massaging roller which swings about the knob in a small circle as the crank is turned. With this the inventor proposed to produce an "artistic dimple" of almost any size you might want.

People Invent

Archives of the Patent Office

KETCHUM

Equally novel is a wonderful beautifier for men—one which might enhance the service in any well-equipped barber shop. It is called the "Hair Planter." Convinced that the way to put hair on a bald-headed man is to set out a new crop, the inventor patented a machine to puncture the surface of the desert scalp and to plant a little sprout of hair in each puncture. He informs us that the sprouts to be thus planted should be "thoroughly sterilized, or otherwise treated to make them as staple as possible."

EVER since there were railways inventors have been racking their brains for foolproof ways of preventing grade crossing accidents. The result has been everything from the hand operated gate to the latest suggestion for an electrified water spray controlled from the approaching train. Under the date of April 7, 1885, however, we find a patent that takes the prize for originality. This inventor proposed to attach the gates in front of the locomotive! They were to be in the form of lazy tongs which could be shot out ahead of the cowcatcher, or pulled in, as circumstances demanded. Not the least part of the invention was a warning whistle at the tip of the lazy tongs. This was so contrived that it could be employed also to shoot a jet of steam at any cow that might wander onto the tracks.

As for preventing train collisions, a high mark for ingenuity undoubtedly should go to the inventor who, in 1895, got a patent for a "Railroad Train" that would let an approaching train crawl right over its back. The idea was to have every train carry a trestle running along the top for the full length, and inclined at both ends. To make this possible the tops of the front and rear cars were to slope down to the level of the track. By this leapfrog system, the inventor explained, two-way traffic might continue without a hitch on a single track.

DEVICES for human safety always have been favorites with inventors. Back in the 1870's, when buildings were growing taller, ingenious minds turned freely to the invention of new-fangled fire escapes. One of the oddest of these, patented in 1879, was in the form of a parachute attached to a headgear worn by the escaper. With this, declared the inventor, "a person may safely jump out of the window of a burning building from any height, and land, without injury and without the least damage, on the ground." He further provided overshoes with thick rubber soles "to take up the concussion with the ground."

Household pests have offered another attractive field for inventive effort. Some of the results are astonishing. A shining example is a "Mouse Trap," patented in 1908, and based on the theory that the "sound or tinkling of a bell is as a rule very terrifying to rats and mice, and that if pursued by such sounds they will immediately vacate their haunts and homes, never to return." This trap is designed so that when the mouse grabs for the cheese he sticks his head through a little spring collar that immediately closes about his neck. On the collar is a tinkling bell. The mouse escapes and runs back to his hole, ringing the bell, and the other mice all run away.

ANOTHER knock-out, of the year 1898, is an "Electric Bedbug Exterminator." The bed to be vacated is wired with a network of high voltage circuits, with small gaps and contact points at intervals in the wiring. When one of the bugs bridges one of the gaps, like a switch, it is jolted into eternity—and out of the bed. Humane is the electrocution of bedbugs.

A classic of a similar order offers a simple way of catching tapeworms. It is called a "Tapeworm Trap," and was patented in 1854. According to the description, "the trap is baited, attached to a string, and swallowed by the patient after a fast of

(*Continued on page 136*)

Will It Be a Boy or a Girl?

Strange Tests with Animals and Plants May Result in a Method of Predicting Sex of Unborn Babies

By PETER VISCHER

THE riddle of sex determination, with which the Sphinx of Life has challenged men and women since time immemorial, soon may be solved by science. Extraordinary progress has already been made and research now under way in many lands forecasts a solution of the problem.

Recent experiments by Russian and German scientists, word of which has just reached America, indicate that prenatal sex diagnosis is already possible with an accuracy of ninety-nine percent. In other experiments quite unrelated, American and European scientists have succeeded in changing the sex of certain animals, such as pigeons, salamanders, fleas and hens.

In other words, it is now possible, according to these European scientists, for parents to learn whether their baby is to be a boy or a girl. Further, it is not beyond possibility that, by scientific means, the sex of human beings some day may be changed before birth, or even later. Finally, it may even be possible some day for parents to bring about the birth of a boy or girl, as they wish.

A chemical process for sex diagnosis has been worked out in Russia by Dr. E. O. Manoilov and Dr. O. Gruenberg, who announced that by this method they can tell definitely the sex of an animal or plant merely by testing a few drops of blood or of plant juice.

As applied practically, the blood of a mother would be submitted to test. If her child was to be a boy, the test would disclose traces of male blood, for the chemical reagent used by the Russian scientists causes male blood to lose color, but has no effect upon female blood.

Dr. Manoilov's explanation is that the change in color depends on differences in the hemoglobin, or red coloring matter of the blood. In order to see whether the theory also applied to the green coloring matter in plants, which is chemically similar to hemoglobin, the experimenters tested their process on plant solutions. They found that the plant extracts responded to the tests as definitely as did animal blood.

AT ABOUT the same time scientists in Germany were pursuing a similar investigation. They used and refined what is known medically as the "Abderhaden reaction," based on the same theory developed by the Russian scientists. This reaction was found effective in seventy-eight cases out of 100.

Dr. Sellheim, professor of gynecology at Halle, Germany, and his assistants, Doctors Lutge and von Mertz, elaborated on the reaction until the test acquired an accuracy of ninety-nine percent and more. They made the interesting discovery, incidentally, that in the case of twins of different sexes the development of a boy child is indicated. Also, that the birth of an extremely delicate boy usually results in the reaction that signalizes a girl, which accounts largely for errors.

The reports of these experiments have been studied at the Department of Genetics of the Carnegie Institution of Washington, which has an extensive laboratory at its Station for Experimental Evolution at Cold Spring Harbor, N. Y. Here tests on plants were found to substantiate the Russian and German results, though Miss Sophia Satina, Dr. A. F. Blakeslee and M. Demerc, the scientists who worked on the tests, are not yet ready to make details public.

Sex diagnosis, however, presents a comparatively simple problem as compared with sex transformation and sex determination. It is known that heredity operates in such a way as to assure nearly equal numbers of the two sexes. Sex is normally fixed and inherited in much the same way as are stature, color and other hereditary characteristics. So, it must be apparent that the transformation of sex involves too a transformation of these other characteristics.

There are, though, at least three cases thoroughly authenticated by scientists that show a complete transformation of the sex of adult animals.

Champy, a renowned French investigator, noticed the change on a salamander as the result of experiments begun in the spring of 1920. He subjected a male Triton to severe fasting. In time, the salamander lost its distinctly male characteristics and assumed a "neuter" condition, quite unlike that of females but similar to the condition normally assumed by salamanders in the winter. By the next spring this and other males used in the experiments had lost definitely all male characteristics.

Two males severely fasted in the summer of 1920 were later intensely renourished. And in the following winter they were found to have assumed not merely a "neuter" condition but a distinctly female appearance. One of the specimens died, but a few months later the other could not be distinguished from a typical female.

THE second case was that of a hen that became a rooster, recently observed and described by Dr. F. A. E. Crew of the University of Edinburgh. A certain Scot owned a Buff Orpington hen and kept her till she was three and a half years old for the purposes of laying eggs and rearing her young. Six months before the bird was brought to Dr. Crew's attention, the hen stopped laying eggs and began to show signs of disease.

Dr. Crew took the bird into his care at a time when she was still nearly normal in appearance, though a tendency to crow had made her annoying to her former owner. For twenty-two months Dr. Crew nursed the bird. Its health was restored, the comb notably enlarged, and spurs were developed from the merest rudiments to nearly two inches in length. The bird also assumed the plumage and fighting manners of a cock. It unhesitatingly fought with cocks and became the father of two chickens. Thus, according to one scientist, "at least one dimly-lighted intelligence of our time has achieved both motherhood and fatherhood of a noisy, persistent and fruitful portion of the life of the earth."

THE third case of complete sex transformation is that of a female ring-dove which became a male under the observation of Dr. Oscar Riddle of the Carnegie Institution. Dr. Riddle has been studying pigeons for fifteen years and has reached the conclusion that sex is determined by metabolism, that is, by the rate of oxidation at which food is built up into body tissues.

Dr. Riddle's pigeon, when she came under his observation, seemed no different from thousands of others. Careful records were kept of her and these show that (*Continued on page 136*)

Can Science Regulate Sex?

SEX diagnosis—predicting whether an expected child is to be a boy or a girl—is a problem that has challenged eminent scientists since the earliest days. Yet not until recently, as Mr. Vischer tells in this fascinating article, has a method of sex diagnosis been developed that would stand scientific scrutiny.

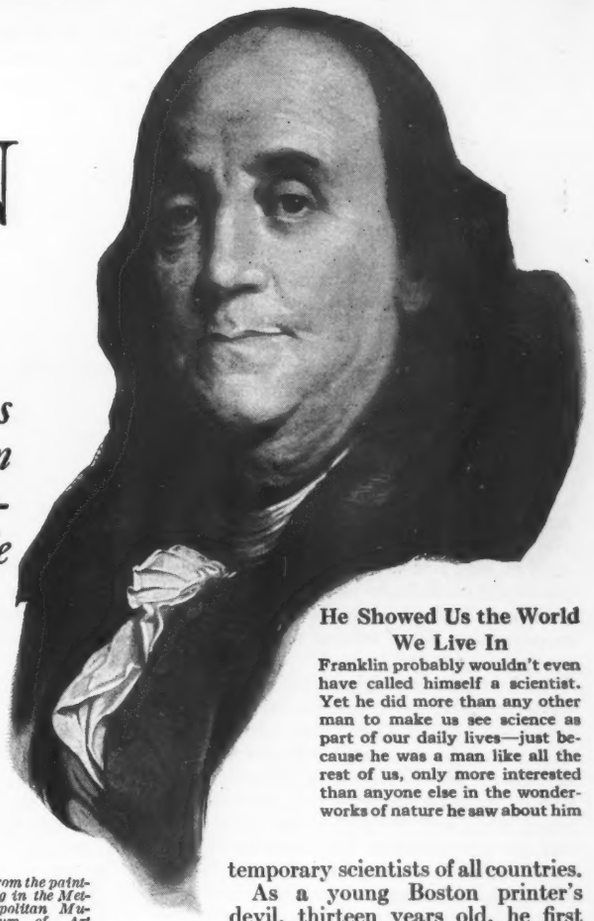
And now scientists are endeavoring to solve a problem that is even more perplexing—sex determination—regulating the sex of an unborn child according to its parents' wishes.

Though experiments with plants and animals have yielded some astonishing results, biologists and medical men are divided in opinion as to the possibility of applying the knowledge gained in these experiments to the human race.

The First Great SALESMAN of Science

Benjamin Franklin, Whose Genius Turned a Whole World's Attention to a Strange New Field—His Romantic and Epoch-Making Life

By ARCHIBALD DOUGLAS TURNBULL



From the painting in the Metropolitan Museum of Art

He Showed Us the World We Live In

Franklin probably wouldn't even have called himself a scientist. Yet he did more than any other man to make us see science as part of our daily lives—just because he was a man like all the rest of us, only more interested than anyone else in the wonderworks of nature he saw about him

TO EVERY American, Benjamin Franklin must mean something. Maybe to you the mention of his name calls up a picture of a rather portly old gentleman, ducking down behind an almanac and popping up to pelt the passer-by with such maxims as "Early to bed, early to rise." Others see him as a huge but indistinct shadow in the background of the Revolution, reflected upon all the pages of its history. And there must be those who remember him as the treaty maker, a diplomat and a statesman. These widely different ideas of Franklin are the penalty that history has exacted from his versatility.

Every side of him is interesting, not because he was the plaster saint that some insist upon making him, but because he was essentially a very human being, blessed with a broad, active, tolerant mind, a thirst for knowledge, a singular capacity for self-analysis, and, best of all, a rarely equaled facility for telling what he believed or knew in such a way that anyone could understand him.

But of all the reflections of Franklin, none is more interesting than the scientific one. For a picture of this side of the man we have only to remember the experiment with the kite by which alone he earned the right to be called the first American popularizer of science.

In 1752, near his Philadelphia home, say the old authorities, Franklin carried out this interesting, remarkable experiment. Into the thunderclouds above his head he flew his kite, watching its flight with eyes that betrayed alternately doubt and hope.

This kite was just an ordinary one, but it was made from a fine old silk handkerchief. At the top there was a thin wire, while at the lower end of the hempen string, by which the kite was controlled, was fixed a metal key. To the key was tied a silk ribbon, and this ribbon Franklin held in his hand.

A cloud passed and into his face crept a hint of disappointment. Another hovered over the kite, and the loose strands of the hempen string stood out stiff and bristling. Franklin held a finger toward them and they were attracted. Then he put his finger on the key, instantly saw the electric spark, and felt a shock. That proved his theory that lightning and electricity really are identical.

Franklin's time was at the beginning of the American age of science, invention, achievement, and progress. Men were rubbing catskins upon amber or glass in experiments in electricity, with virtually no knowledge of the stupendous force behind the sparks they produced. Other men were trying to propel boats by such crude methods as steam-driven oars, while there was not even a hint of a *Leviathan*. American inventive genius was stirring in the minds of men who, because they had to fight nature for a living, were beginning to investigate natural forces and phenomena. Franklin's own mind was a fertile field in which these seeds of science took early and productive root.

OBSCURELY born, in Boston in 1706, one of seventeen children, he had no patrimony and few prospects. When little more than a baby the lad who was to die the most influential single individual in the world was apprenticed to his brother James, proprietor and publisher of *The Courant*, one of New England's earliest newspapers. James beat into Benjamin a real knowledge of the printer's trade. The mechanical dexterity which his fingers had to acquire to escape a ruler across the knuckles, prepared the boy for the more sensitive scientific instruments which the man was to handle later.

And then there was a natural eagerness to learn that drove him to borrow any book within reach—no matter how dull—to study it, put it aside, and paraphrase it. Thus he was able, years later, to produce letters and essays on scientific subjects so clear that they might have served as children's textbooks, yet so convincing that they have ever since maintained his claim to a high place among the contemporary scientists of all countries.

As a young Boston printer's devil, thirteen years old, he first turned inventor. It was his great fondness for swimming, coupled with a natural desire to outshine his companions, which led him to build a big kite and to experiment with the force of the wind as it blew over his favorite swimming hole. His own words describe this event:

"I found that, lying on my back and holding the stick (of the kite string) in my hand, I was drawn along the water in the most agreeable manner. I have never, since that time, practiced this mode of swimming, tho' I think it not impossible to cross in this manner from Calais to Dover."

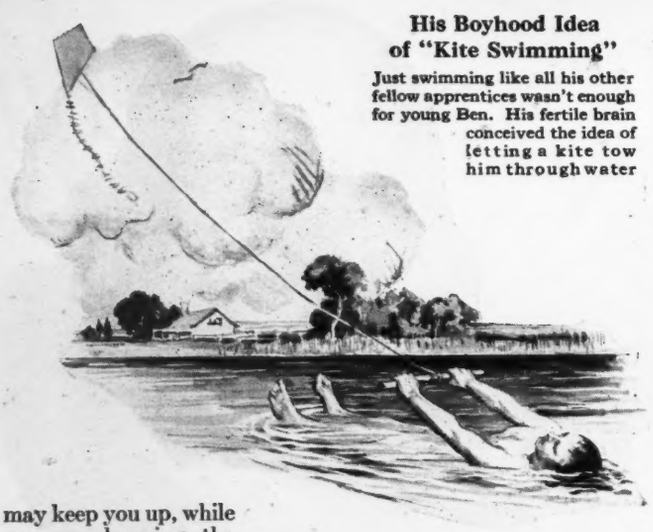
Up to date, none of the persistent cross-Channel swimmers seems to have made use of Franklin's method. But, were he alive today, it would be characteristic of him to try it himself, if only to demonstrate to his own satisfaction that his invention had a correct foundation in physics.

EQUALLY practical in application was his design, at about this same time, for a pair of paddle-sandals, with which his feet could cut out such fancy strokes, over the water or under it, as to make his rival apprentices stop toweling their wet heads and stare at him in amazement.

Swimming always fascinated Franklin. Years afterward we find him writing to a friend who wanted advice:

"I cannot agree," he said, "that it is too late in life for you to learn. Try the river, first, and have confidence. If you are afraid of water, to which your employment often takes you, there can be nothing better than learning to swim."

As to "corks and bladders," Franklin was not so sure of their value. "They



His Boyhood Idea of "Kite Swimming"

Just swimming like all his other fellow apprentices wasn't enough for young Ben. His fertile brain conceived the idea of letting a kite tow him through water

may keep you up, while you are learning the strokes, but you will be no swimmer until you learn confidence in the water to support you." And, since he always had a constructive bit of advice ready, he proceeded to give it:

"Choose a place where the water deepens gradually, and walk in coolly until it is breast-high. Turn around, face to shore, and throw an egg between you and the shore. It will sink and be easily seen, but it must be so deep that you cannot reach it without diving. Encourage yourself by remembering that you are going from deeper to shallower water—and plunge for that egg. Keeping your eyes open, try with your hands and feet to reach it. Then you will discover that the water, holding you up, makes this difficult for you and, at the same time, your efforts will teach you what to do with yourself in the water."

Four years of intensive training under James was enough for Benjamin, and at seventeen we find him running away to Philadelphia—the city ever afterward linked with his name.

That was the wisest move he could possibly have made. Not even his curiously voracious intellect could have found in the Boston of his day either opportunity or time to feed upon science as its favorite meal.

UPON the other hand, there already existed in Philadelphia an entirely different atmosphere. In the long list of celebrated men who lived in, or frequently visited, that city, there were many intensely interested in various branches of science.

There, for example, was a group absorbed in the study of astronomy, among them David Rittenhouse, inventor of the metallic thermometer, developer of the construction of the compensation pendulum, student of the compressible quality of water, and designer of an apparatus to illustrate the motion of bodies in the solar system. With this last, he observed the movements of stars, notably the transit of Venus at about the middle of the century; a typical instance of Philadelphia's leadership, for there appears to be no record of observations of this event in other colonies. The result of every such observation was of interest to Franklin and, when he could find time, he assisted in making them.

Similarly, it was certain to prove an inspiration to Franklin that in Philadelphia were founded the first colonial medical college and the first hospital. Here, for instance, was produced Dr. Robert Hare, Jr., inventor of the oxy-hydrogen blowpipe and general physicist of wide repute. In such surroundings, Franklin could not have avoided science, even if he would.

On the way from Boston to Philadelphia, he conducted a scientific experiment with himself as subject. After being shipwrecked on his way to Perth Amboy, N. J., he was extremely sick, and this is his description of his effort to effect a cure:

"In the evening," he writes, "I found myself very feverish, and went to bed. But, having read somewhere that cold water, drank plentifully, was good for a fever, I followed the prescription, sweat plentiful most of the night; my fever left me and, in the morning, crossing the ferry, I proceeded on my journey on foot."

Since he made extraordinarily good time in the next two days, it seems that his remedy must have been a good one. Ever afterward he remained a believer in cold water, inside and out.

IN PHILADELPHIA, Franklin found employment as a printer's devil with one Keimer, a hopelessly inefficient individual whose shop equipment was of the poorest. Having converted his employer to a diet of vegetables, Franklin reports that he "got along very pleasantly."

Shortly after, there walked into Keimer's shop the resplendent Sir William Keith, Governor of Pennsylvania. Keimer stepped forward, bowing—then, as Franklin said, "stared like a pig poison'd" at finding it was not the boss but Benjamin, the apprentice, that was wanted—all because Sir William had seen and liked one of his letters.

Out of a friendly glass of Madeira, bought by the Governor and drunk by the apprentice, came a plan to send Franklin to London to buy whatever he needed to set up a printing shop of his own. However, Keith's promised letters of introduction, which were to open all English gates, were not forthcoming. And so Franklin, landing penniless in London, had to go back to the only trade he knew.

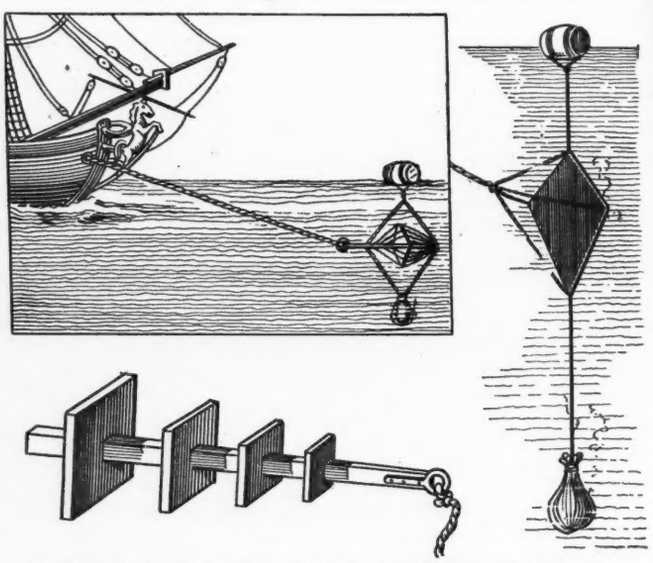
Working at the British press made him more than ever expert with his fingers and, on the side, he picked up type founding. His "constant attendance" upon the job when others were incapacitated, together, he tells us, with his "uncommon quickness at composing," again resulted in his "going on very pleasantly."

Again, at "The Horns," a club which he frequented, his associates were the free-thinking individuals who made a Cheapside alehouse their headquarters. Through them, he made acquaintances among doctors—Lyons, Pemberton, and Mandeville—and others interested in science. These contacts exercised his mind and stimulated his imagination. For example, a promise of an introduction to Sir Isaac Newton—even though it appears never actually to have been performed—was quite enough to set Franklin digging into scientific books in preparation for so momentous an event.

WITHOUT doubt, the links formed in those early days were nearly all of one chain—the student's. His keen observation was brought to bear upon hundreds of things that were to affect his later life. And his writings of the period, although chiefly devoted to such youthful outbursts as "Liberty and Necessity, Pleasure and Pain," nevertheless are marked with that smoothness of pen which was to make his later, more important, papers so peculiarly lucid.

It was his really professional knowledge of swimming which won him prominent English notice. This knowledge he had acquired by studying, from his early youth, the best methods of handling the human body in the water—"aiming at the graceful as well as the useful." Returning from a visit to the countryside, with several men, he "stripped, leaped into the river, and swam from near Chelsea to Blackfryars, performing on the way many feats of activity, both upon and under water, that surpris'd and pleased those to whom they were novelties." This very nearly brought about his remaining in Europe as head of a traveling

Jottings from Franklin's



Franklin never saw anything or did anything without evolving a scientific theory, then trying to prove it, and finally sharing his discovery with others. These anchor ideas were results of his few sea voyages

swimming school and the loss of Franklin to fame. A proposal that he open such a school in England is referred to by Franklin as having "struck me so forcibly" that, had it been made sooner, "I should probably have accepted it."

Finally, however, Franklin was persuaded by Mr. Denham, a kindly merchant of Philadelphia whom he had met on the eastern voyage, to return to America as Denham's clerk. On his way home Franklin kept a journal that contained striking instances of the interest he was ever afterward to take in the sea and its phenomena.

He observed the fish and the birds, with as much as he could gather, in passing, of their habits. As for the heavens, he sat up all one night to watch an eclipse of the moon, due, by London time, to begin at 5 a.m. September 30, 1726. He describes the first shadow as beginning about 11 p.m. on the 29th, at the ship, and increasing, to "darken her body about six digits or one half," at 2 a.m.; "the middle being at about 12.30, by which we may discover that we are in a meridian of four and a half hours from London, or 67½ degrees of West Longitude."

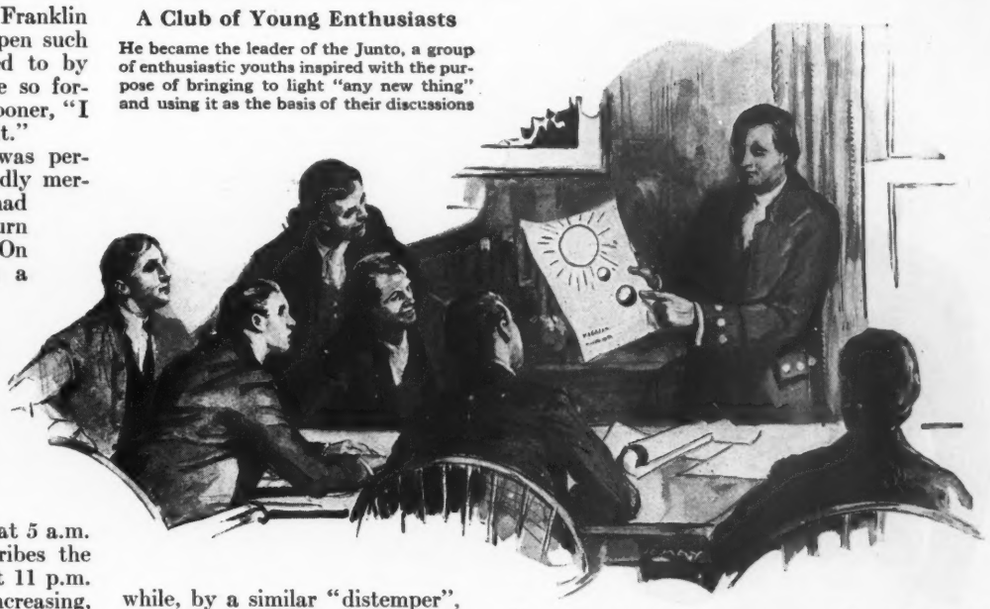
THREE days later, he "cannot help fancying" that the water has changed color, a sure sign of nearing land, or, at least, soundings. When captain and mate will not agree to this, Franklin admits that the wish may be father to the thought—an admission which proved well founded when his reckoning was found to be in error.

It seems probable that Franklin did not suppose he would ever make practical use of the science of navigation. But he was unwilling that the storehouse of his mind should have no pigeonhole for the subject, in case it ever should come up again.

Working under Denham, and dropping printing for dry goods, formed a short lull in Franklin's life. It gave him the opportunity to go through a desperate illness which nearly ended his career while, by a similar "distemper", he lost his good friend and employer. He was thus left, as he expresses it, "once more to the wide world", with no recourse but a return to Keimer.

A Club of Young Enthusiasts

He became the leader of the Junto, a group of enthusiastic youths inspired with the purpose of bringing to light "any new thing" and using it as the basis of their discussions



However, as foreman of Keimer's shop, Franklin immediately made practical application of his London experiences. There being, apparently, no letter founders in Philadelphia, he "contriv'd a mold, made use of the letters we had, as puncheons, struck the matrices in lead, and thus supply'd, in a pretty tolerable way, all deficiencies". With some little success, too, he tried his hand at engraving, at the same time mixing the inks for the house, as men did in those days, with powder and water. In short, he became the real handy man of Keimer's establishment; still another step in mechanical training and preparation.

A LITTLE later he started a printing office of his own, with a rather unsatisfactory partner named Meredith. For some years he was extremely busy. While his fingers were flying, literally day and night, over such jobs as that early contract for forty pages of Quaker history—"pro patria size, in pica, with long primer notes"—it was hardly to be expected that he should find leisure for conducting those scientific experiments in which his soul delighted. It was less to be expected when it is recalled that it was at just about this time that he bought a newspaper and made it over into "The Pennsylvania Gazette", the forefather of *The Saturday Evening Post.*

Yet, at this period, he did find time, somewhere, to become the organizer and very active leader of the Junto, a club of about a dozen members, meeting every Friday night "to tell or to hear some new thing". Although the Junto was willing to take up any topic of contemporary interest, its tendency, inspired by Franklin, was largely toward the scientific. This is plainly shown by the list of stock questions which it was the custom to read out every time the club met. Take, for example, the very first question:

"Have you met with anything, in the author you last read, remarkable or suitable to be communicated to the Junto and discussed by us, particularly in history, morality, poetry, physics, travel, mechanic arts, or other parts of knowledge?"

Similarly, Franklin frequently directed both the written papers submitted by the various members, and the open debate which followed their reading, into scientific channels. Thus the discussion would often turn upon such points as:

"Is sound an entity—or body?"

"How may the phenomena of vapors be explained?"

"What is the reason that the tides are higher in the Bay of Fundy than in the Bay of Delaware?"

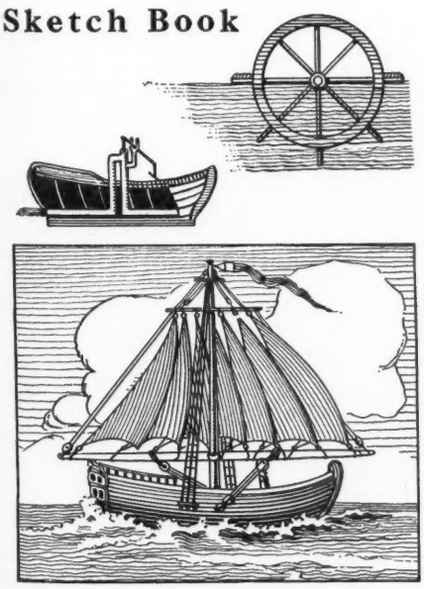
Since Franklin's was much the best mind in the club, he often had to answer the questions as well as propound them. Hence, without any apparatus or corps of lecturing professors, he led his associates, the young carpenters, draftsmen, mathematicians, surveyors and so on, into fields of study broader than those to which they were severally devoted at the outset.

When the opportunity of printing new paper money came his way, Franklin promptly seized it. He wrote an essay which, if not economically quite sound, still proved a strong influence in persuading the legislature to authorize the paper issue. He also showed that he was able to produce from his presses attractive original designs, and won the contract.

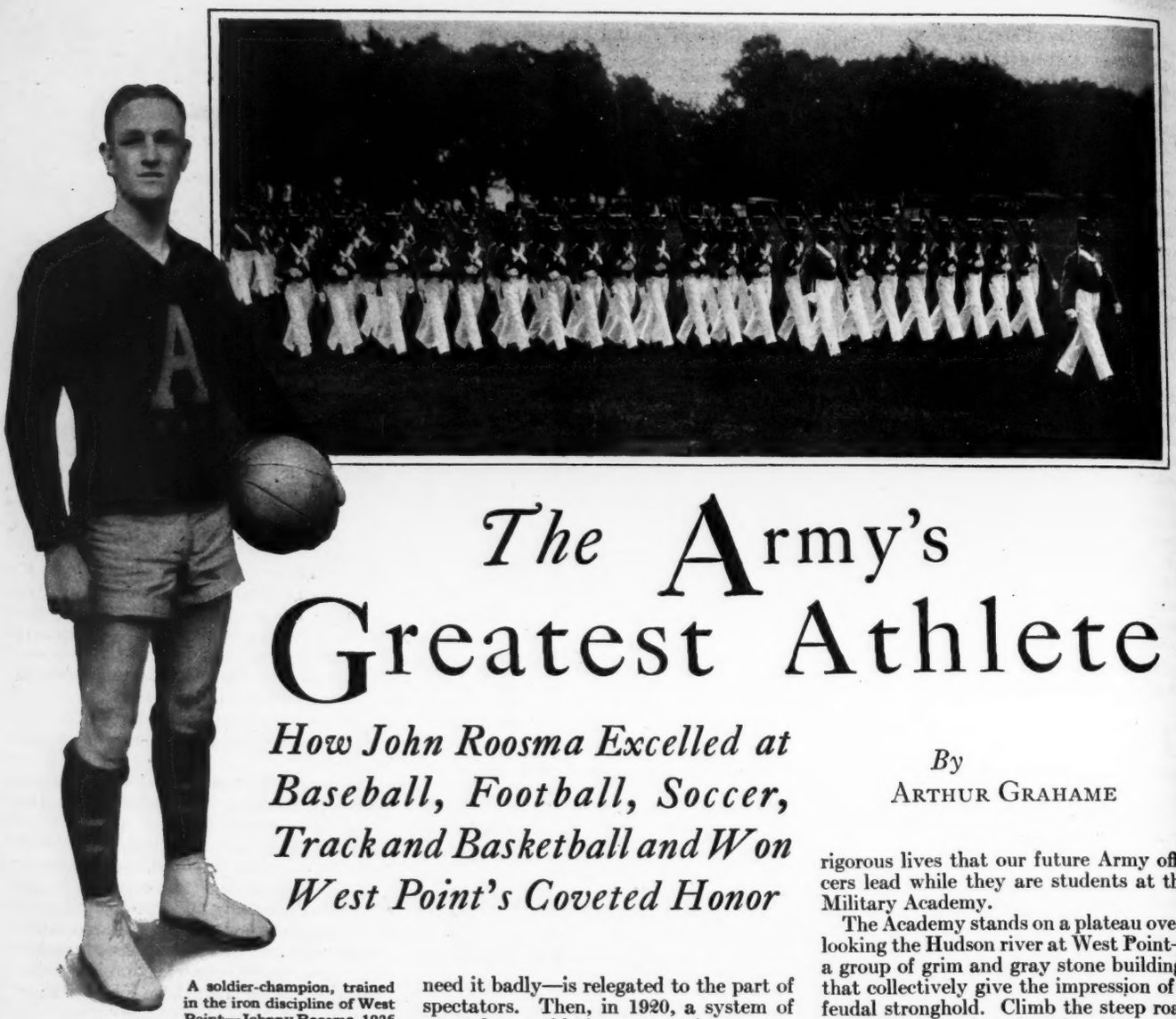
IT WAS during those close-packed years that he "ventured over all obstacles and took Miss Read to wife". However, as this was a marriage much more of comfortable convenience than of romance, it did not interfere with the Junto or with other activities outside his home. On the contrary, the acquisition of several children spurred him to fresh educational activities. These resulted in the founding of that small academy, which was to grow first into the College of Philadelphia and later into the present University of Pennsylvania. Being Franklin's creation, the academy's curriculum laid stress upon such subjects as "natural and mechanical philosophy, agriculture, physics, mathematics, chemistry, and anatomy"; a considerable program when the dry-as-dust quality of the textbooks of the period on these subjects is remembered.

With the Junto as his first weapon, and the widest publicity as his ammunition, he hammered (*Continued on page 134*)

Sketch Book



He thought he could improve on the methods of propelling boats, so he sketched this sailboat, paddle wheel and oarless rowboat



The Army's Greatest Athlete

How John Roosma Excelled at Baseball, Football, Soccer, Track and Basketball and Won West Point's Coveted Honor

By ARTHUR GRAHAME

A soldier-champion, trained in the iron discipline of West Point—Johnny Roosma, 1926 winner of the coveted Saber

"EVERY student an athlete." That is one ideal toward which most of our colleges are striving, now that the health-building, character-forming and brain-quickening values of competitive athletics are acknowledged by nearly all of them.

What the civilian colleges are still striving toward, however, is no longer the distant ideal—it is the accomplished achievement—of the United States Military Academy at West Point.

The training of "officers and gentlemen" for the leadership of the Army has been the business of West Point for well over a century. After several false starts, the first at Washington's suggestion in 1794, the Academy was placed on a working basis by Act of Congress in 1802.

Physical training was stressed from the institution's beginning, and for many years competitive athletic sports were an important feature of Academy life. But until recently they were the kind of competitive athletics that bring down showers of criticism on civilian colleges; the kind in which the training of varsity teams—composed mostly of "natural athletes" who least need athletic training—gets nine-tenths of the attention, and the general student body—composed mostly of men who need athletic training, and often need it badly—is relegated to the part of spectators. Then, in 1920, a system of compulsory athletics was put into operation at West Point, and the product of the Army's school became "an officer, a gentleman,—and an athlete."

Each March, West Point holds a big indoor athletic meet in which 300 or more cadets compete for individual, class and company honors in track and field events, swimming, boxing, wrestling, gymnastic events, fencing and handball. At the conclusion of this meet, two silver sabers are awarded to members of the senior class. One of them, the Edgerton Saber, is presented to the outgoing football captain. The other, the Army Athletic Association Saber, is awarded to the first-classman who has excelled in general athletics during his four years at the Academy.

TO WIN athletic supremacy in an institution where every student is an athlete is a man-sized task. The Army Athletic Association Saber is, therefore, the most highly prized of the many athletic trophies offered for cadet competition.

This year the Army Athletic Association Saber was won by Cadet—now Second Lieutenant—John S. Roosma, of Passaic, New Jersey.

To appreciate fully the magnitude of Roosma's achievement it is necessary to know a little about West Point, and the rigorous lives that our future Army officers lead while they are students at the Military Academy.

The Academy stands on a plateau overlooking the Hudson river at West Point—a group of grim and gray stone buildings that collectively give the impression of a feudal stronghold. Climb the steep road that leads from the railroad station to the post, and you will find yourself on the campus of a college vastly different from the easy-going college of civil life.

There are students, of course, but they are not like other college students. They do not smoke pipes or cigarettes, nor wear coonskin coats in winter, or plus-fours and golf sweaters in the spring. These students are buttoned up tightly in close-fitting gray uniforms. They march in squads, with their heads up and their shoulders back, and the air of men who have no time to waste. Nor have they.

EVERY minute, almost, from the time a bugle wakes them in the early morning until another bugle sends them to bed at night, is taken up by an endless round of classes, drills, inspections and rigidly supervised athletics. Iron discipline has them in its grasp.

This all-embracing discipline is carried into West Point's athletics. If you like golf, you could probably imagine no better way of spoiling your game than being ordered to fall in, in a specified formation, at 3.15 p.m. on a certain day, attired in a "white sport shirt, black tie, gray trousers, white rubber-soled shoes and uniform sweater," to be marched to the fourth tee of the West Point golf course for instruction in the ancient and exasperating game. But, under these circum-

stances, would you dare slice your drive or miss a two-foot putt? West Point discipline might even improve your golf!

Athletics are taught at the Academy for three reasons—first, because of their health-building value; second, because they provide the cadets with healthful recreation and a change from classroom work and drill; and third, because modern conditions make it necessary for every Army officer to know sports so that he will be able to teach them. He may be ordered to act as athletic officer or team coach for a Regular Army unit, a Students' Officers Reserve Training Corps, or a Citizens' Military Training Camp.

THERE are spring and fall athletic terms. During the spring term, instruction is given in lacrosse, baseball, track, golf, tennis, football, fencing and gymnastics; during the fall term in football, basketball, soccer, track, tennis, golf, fencing and polo. These athletic activities replace drills on alternate days.

Competition between company teams is keen, and many good performers are developed. Naturally, this makes it more difficult for any individual athlete to stand out from among his fellows—a circumstance that gives added glory to the winner of the Army Athletic Association Saber.

Which brings us back to Cadet—now Second Lieutenant—Johnny Roosma.

Roosma made a remarkable record in his fight for the Army Athletic Association Saber. He played on the basketball team for five seasons, and was considered the most brilliant forward the Academy has ever had. He was awarded the Army major sport "A" each year, and last winter was captain of the team. He played on the baseball team for three years, filling, at various times, the positions of first base, third base, shortstop, center field, and pitcher. That gave him three more major sport letters.

Unlike most winners of the saber, he never won his "A" in football, although he was a member of the squad for three seasons. That was a big handicap to him in trying to win the saber, but he overcame it by brilliant performances in other sports. He was a member of the varsity soccer team last fall, and won a minor sport "A." He also was a member of intramural track and baseball teams, and won the grade of "sharpshooter" with both rifle and pistol. Finding that he had a few moments a week to spare, he became a member of the Cadet Choir, and sang in it for three years.

He was appointed a cadet corporal in June, 1925, and cadet lieutenant two months later.

Interviewing Military Academy sport stars is a tough assignment. They hop from a military formation into a game, and from the shower baths to another formation, without a pause. But I managed to have a little chat with Roosma on the field just before a baseball game. He's a husky young man with broad shoulders, stands five feet eleven inches in his baseball shoes, weighs about 180 pounds,—of soldierly gait, but with a freckled face that breaks into a cheerful grin on slight provocation.

"OH, I was just an ordinary sort of kid," he said in answer to my question. "But I guess I was even crazier about athletics than most kids are. No, I didn't care so very much about studying. In fact, I once quit high school for six months, but I went back, and made it up by going through the four year course in three and a half years.

"What game do I like best? Well, I don't think I like any one game best. I like them all, in their seasons. But I was lucky in basketball. When I attended Passaic High School, Coach Ernest Blood was in charge there, and I think he is one of the best coaches in the country. Then here at the Point I've worked under Mr. Blood, and Mr. Fisher, another mighty fine coach.

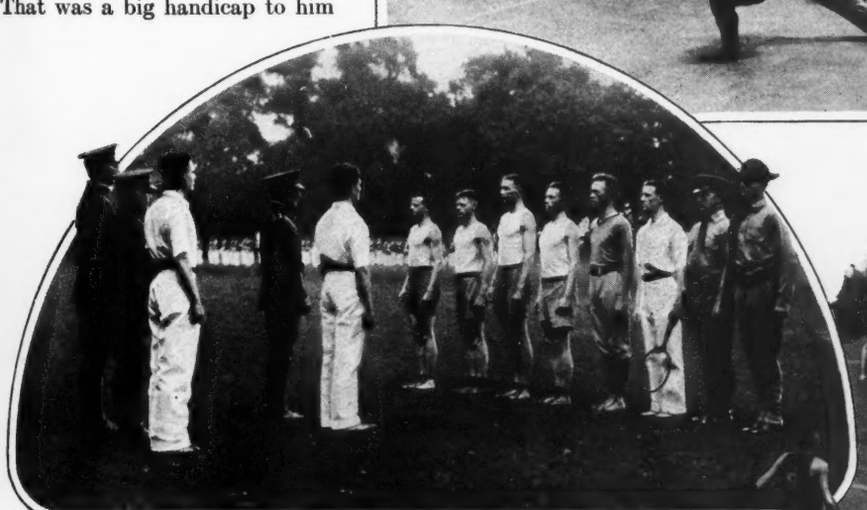
"Baseball's a great game, too. I'd rather pitch than do anything else on the diamond."

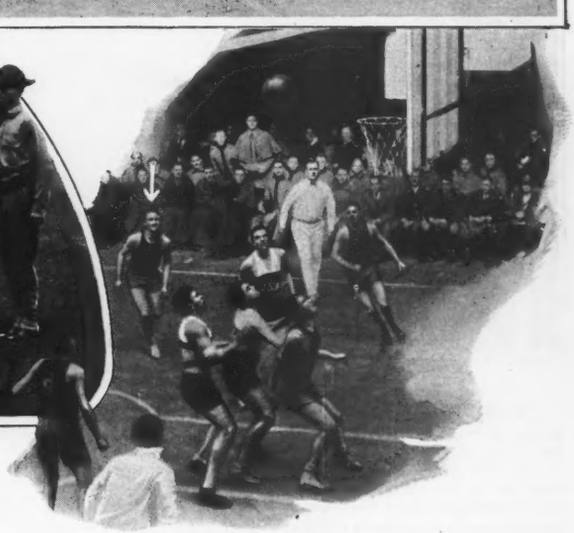
I asked him how he found time for all his activities.

"IT'S the routine helps you out," he replied. "When I first came here, it took me half an hour to fold my blankets the right way. Now I can fold them with my eyes closed, and fix my room for inspection in a few minutes. It's that way with everything—you get used to doing things quick and right. Of course, we don't have as much time to practice sports as they do at most colleges, and that makes it harder. Shooting goals in basketball, for example—that takes lots and lots of practice. Some men never get the knack, especially on long shots. Baseball and football require time to learn, too—there is a lot of inside stuff that a fellow must learn.

"Study? Well, I hadn't been here long before I learned that you had to keep up in your classes if you wanted to amount to anything in sports. It isn't always easy to buckle down to books, but you've got to do it, and a fellow usually can do what he's got to do."

Whereupon Cadet Johnny Roosma departed to warm up for his afternoon's athletic endeavors.

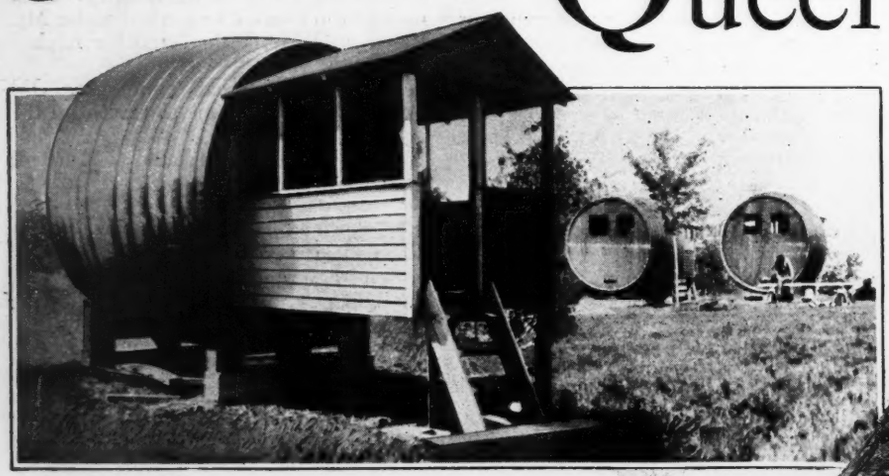




The Making of an Officer, a Gentleman—and an Athlete

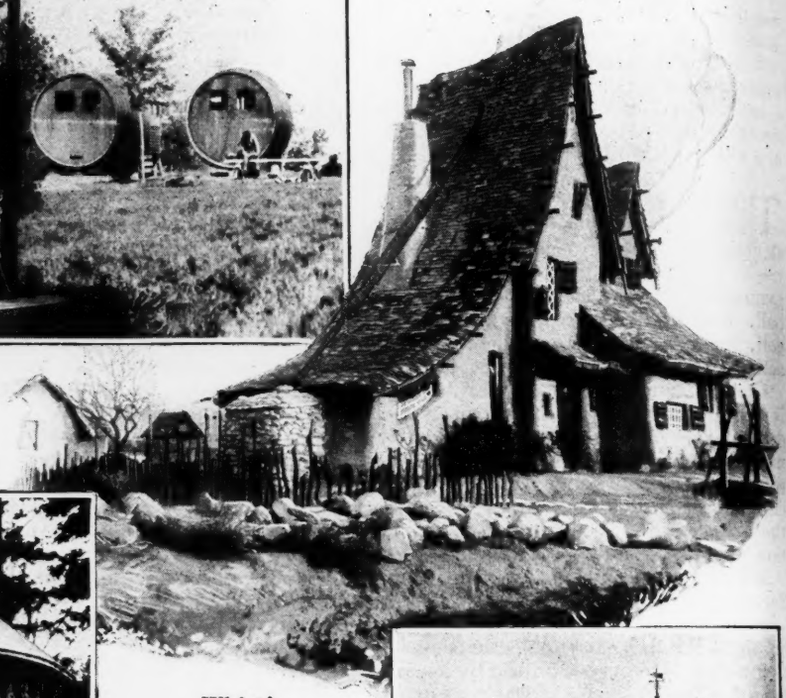
Six years ago West Point inaugurated compulsory athletic training in every branch of sport, and today every graduate is a trained athlete. Above: Cadet champions of various sports receiving their awards at the annual meet. Top photograph: Daily calisthenics, still an important part of the program. Right: The Army and Navy basketball game, 1926, the man under the arrowhead being Roosma

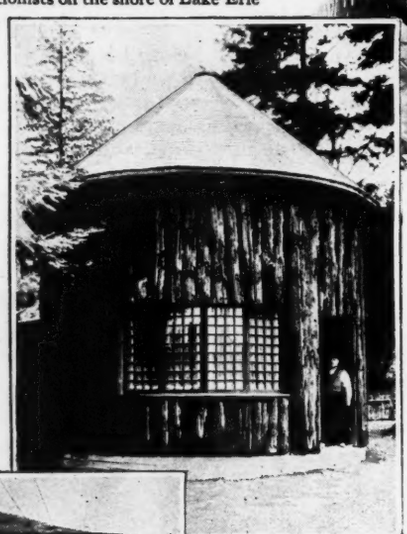
Some People Build Queer Homes!



Life's a Song—in a Wine Cask

The tenants of these "cottages," above, turn up their noses at plebeian barrel dwellers; *they* live in wine casks! Unused since prohibition, the huge casks were converted by W. J. O'Neill, of Vermilion, O., into snug homes for a colony of summer vacationists on the shore of Lake Erie



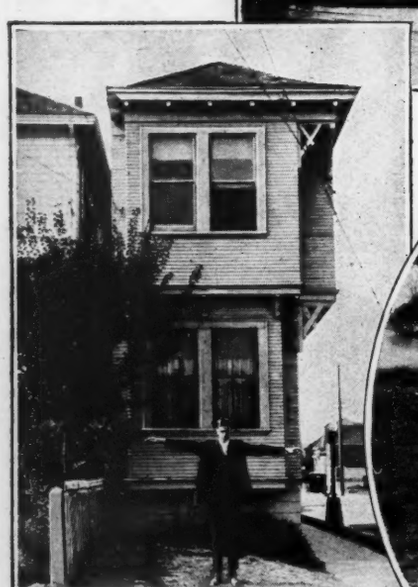


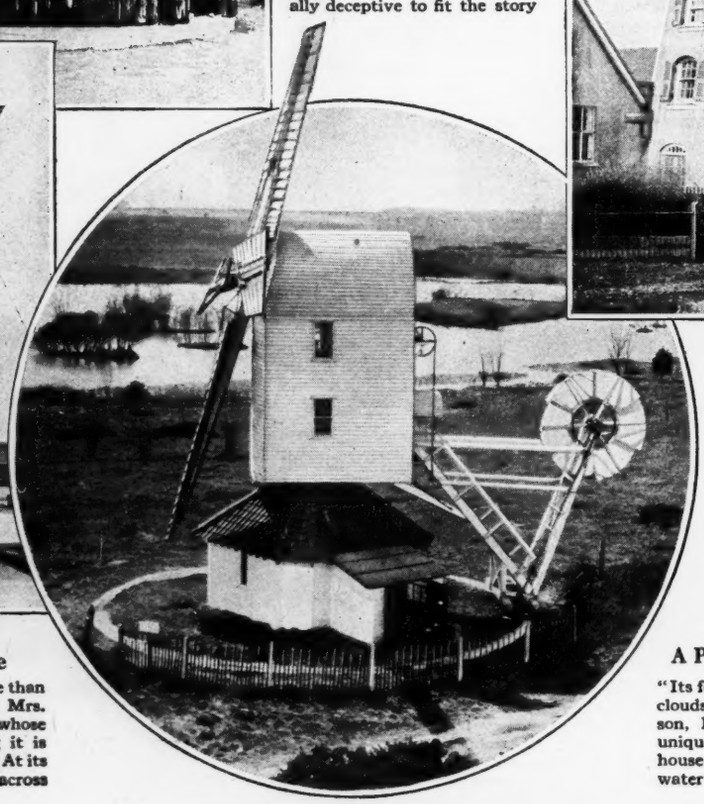
Like a Squirrel in a Tree Trunk

Curious persons so annoy the owner of the home pictured at the right, near Seattle, Wash., that he keeps a "bad dog" sign out front. The spacious living room is made from a single redwood tree, set on a concrete base. A kitchen is attached on the farther side

Whist! The Witch's House!

With its weird fence, fantastic windows and whimsical roof, the cottage above, in Beverly Hills, Calif., is W. Lacelle's conception of the Witch's House of fairy tales. It is a real home, however, its ramshackle aspect being intentionally deceptive to fit the story





Almost a Skyscraper

Those who find romance in circular rooms, winding stairways and round towers may envy the inhabitants of the novel home above. It is in England and was once a windmill, until the housing shortage drafted it into use again

California Gives Us This One

A mere slice of a house, this,—hardly more than the filling of a sandwich! But Mr. and Mrs. Charles W. Miller, of Alameda, Calif., whose home it is, are quite content, declaring it is more comfortable than most apartments. At its widest point it just misses being ten feet across

A Poet in a Water Tower

"Its feet in the gorse, its head in the clouds," is how Mrs. Malcolm Mason, English writer, describes her unique summer home (left). The house really camouflages the village water tower, around which it is built

BIG ONES!

A Page of True Whoppers

Look Pleasant, World!

One look at the gigantic German camera at the left, which takes real pictures and is perfect in every detail, is enough to discourage any camera bug. How can one compete with apparatus like that? Berlin, where all things are "colossal," is now looking for a word with a big enough meaning to describe this recent acquisition

Too Big for Your Laundry

Visitors at the New York Electrical Show found a new marvel in the enormous electric iron (right) shown in comparison with an ordinary-sized iron. It was an amazingly exact copy of the small one, even to all the detailed electrical connections

Wanted: A Race of Giants

To fit the seven-league boots above, shown recently in London. Believing in giants must be easy for children nowadays, seeing that they're evidently provided with everything a giant needs, from shoes to smokes, as these pictures show

A Cake That Took the Cake

The masterpiece of pastry above, baked in England, weighed exactly a ton. It was eaten at a banquet at one sitting to the tune of "Are we down-hearted? No!"

The Vanishing Clock

Anybody can make a clock run; but Gus Fowles, English magician, can make a clock, weighing a ton, vanish. Though of such huge proportions, this clock is said to keep perfect time

One Cigar a Day Enough

Here's hope for the man who enjoys a long smoke! The "mild seegar" above, the largest in the world, is just what he has been looking for. Its little brother, held aloft by the young lady, hasn't a look-in

Tooting Her Way to Opera

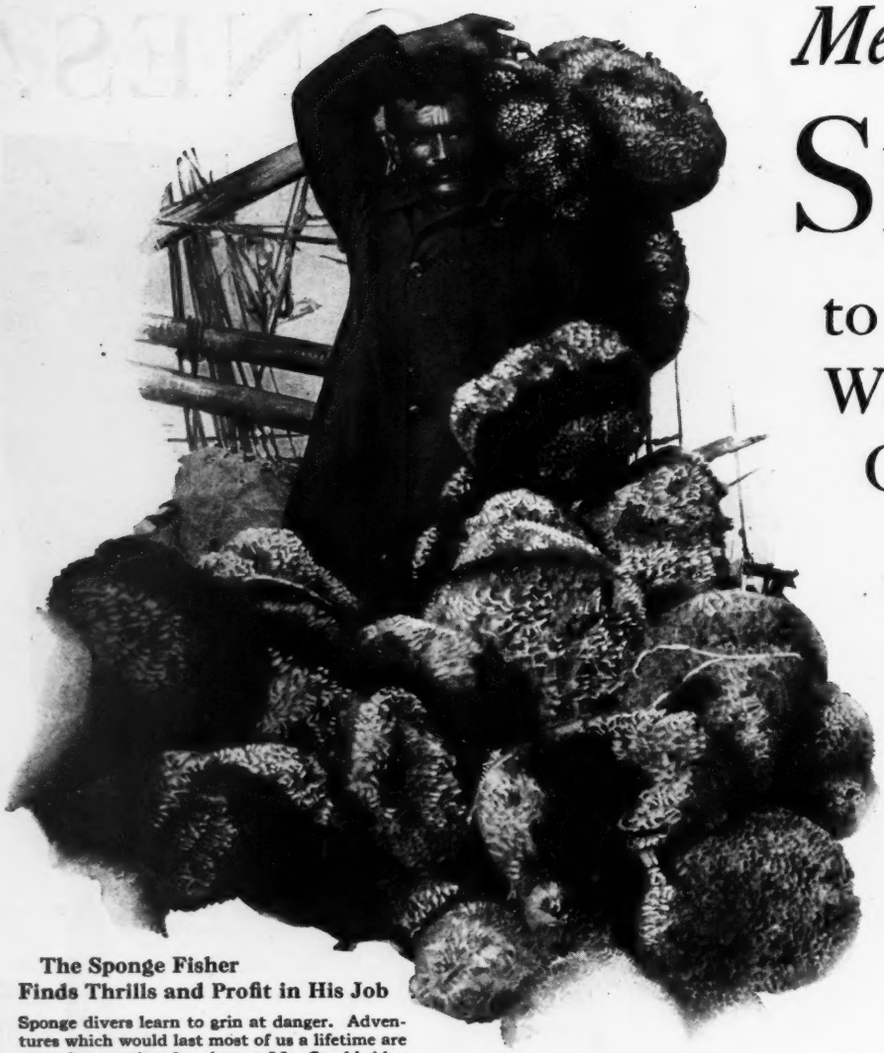
The world's largest bass horn (right) is here shown providing deep breathing exercises for a budding New York opera singer, who needs all her breath to fill it

Men Who Fight

SHARKS

to Wrest Strange Wealth from the Ocean's Floor

By
FRANK PARKER STOCKBRIDGE



The Sponge Fisher Finds Thrills and Profit in His Job

Sponge divers learn to grin at danger. Adventures which would last most of us a lifetime are everyday routine for them. Mr. Stockbridge tells a story of a typical day on one of their boats

"*SHARKS!*"

Young Nick Anagnos, dangling his lead-shod feet over the gunwale of the *Cleanthi*, raised the danger cry just as two of his shipmates were about to place the big brass helmet on his head.

A school of the sharks, thirty or forty of the big white man-eaters that infest the waters of the Gulf of Mexico, had appeared suddenly from nowhere. Triangular back fins projected above the water like the sails of toy boats. Others darted about below, huge forms clearly outlined as swift black shadow-shapes in the translucent water.

It looked like a bad day for gathering sponges, after all.

Captain Cocoris watched the tigers of the sea for a few minutes, then turned and grinned a little bitterly at Nick Anagnos. The young Greek had clambered back on to the deck and squatted by the mast. He emphasized his refusal to take a chance with the sharks by asking for one of the tiny cups of Turkish coffee which comprise the sponge diver's entire daily nourishment until dinner at night. A single shark or two might be all in the day's work, but a school of them—well, Nick was just going to wait a while, that was all. He sipped his coffee with a deliberation that left no doubt.

A good captain never drives his men into danger; he leads them. Captain Cocoris owns five sponge boats, and rarely dives himself. Now, however, he walked over to Anagnos and said:

"Lemme have that suit!"

It was ideal weather for a good haul. If the Captain, who as owner got one third of the profits, besides his share as a worker, wanted to poke his legs in among those fish, it was, in more ways than one, his business.

Nick peeled out of the heavy diving dress, and Cocoris shuffled into it. The four members of the crew were prompt to help him get into the air-tight, watertight casings and the weighted shoes.

"Aren't you running a big risk of getting an arm or leg snapped off?" I asked Cocoris, as they fastened the metal breastplate about his shoulders.

"Maybe," he answered. "Maybe they get me going down; maybe not."

HE SMILED again, and fingered the knife which hung at his belt. It was a sturdy-looking weapon, but not much to trust one's life to, it seemed to me, against a man-eater. Those beasts were as large, as swift, and as deadly as submarine torpedoes.

"How long are you going to stay down?"

"Tut-t'ree hours."

He saw my look of surprise. I wondered at his nerve in exposing himself so long to the danger of being ripped in two by the sawlike teeth of the sea monsters. He hastened to explain that there was comparatively little risk—that is, once he reached bottom.

"Sharks don't bother you much when you underneath. Sharks bite you maybe sometimes going down; they got to be under what they go after. When you down, they 'fraid of you. You got this helmet on and you look ugly devil, like they do. If you see one coming you squeeze your hands between your knees, so, like this. You got your hands out free and the fish know by the smell that you something to eat. But when you cover your hands up the fish don't know you. Then you knock your feet together like this way—see, they got iron in them, these shoes, and under the water it make big noise; scare the sharks away, all of them."

"But divers do get eaten by sharks, or lose their arms or legs, don't they?" I pursued.

He glanced quickly toward his crew, and made his answer partly for their benefit.

"NEVER been seein' anybody bite by shark in this country. In Greece, maybe, sometimes some diver—skin-diver, what doesn't wear no suits lika this—get hand bite off. But not in this country."

They fitted the Captain's helmet to his breastplate, and for a little while he was cut off from conversation. His face could be seen, oddly distorted, through the three glass windows in the sides and front of the helmet. The great brass dome attached to the cumbrous balloonlike suit, and the heavy clamping shoes, made him indeed look like some kind of devil. Only the exposed hands, sticking out through the tight rubber wristlets, disclosed to any curious shark that there was something inside alive.

Some needed adjustment of the air hose made it necessary to take off the helmet again, and I took the opportunity to ask questions about what went on on the floor of the ocean, when a sponge fisher dives.

"Can you see anything when you get all the way down there, Captain?" I asked.

"You see a little green daylight up there—sometimes you can see the boat.

Pretty dark sometimes. You got to have light here in your helmet." He pointed to the port in the top of the helmet through which a tiny electric storage light could be played.

"Are you able to hear anything?"

"You can hear the air pumping in the helmet. And you can hear the coral go 'crook! crook!' when the waves make it rub together."

Among the equipment Captain Cocoris was taking below was a net for holding sponges and a three-pronged hook for clawing them off their moorings on the bottom.

"Do you come back up as soon as you get your net filled?"

"Naw; I got this rope, see, to make signs with. You goin' down empty. You fill the net with sponges, you make it, three times, signs with the rope, then they pull up full and send down empty."

With a final glance around for lurking sharks, the Captain inclined his head to receive the helmet, which was fastened to the metal breastplate with screws locking on one eighth of a turn. At the same time the little air pump was turned on and his diving dress began to swell out like a pillow.

Three lines of communication connected him with the *Cleanthi;* the air hose, a hawser with which to lower him to the bottom and haul him up again, and another line to which his sponge net was attached, used also for the simple code of signals.

HE CLAMBERED laboriously down the ladder swung overside. As his helmet disappeared below the surface, air bubbles told of his downward progress. The descent was slow, for the air pressure in the suit has to be increased in due proportion with every foot of descent. For every thirty-five feet of water, the air pressure increases fifteen pounds. The diver requires time to accustom his internal blood pressure to the strain. The depth indicated on the air hose increased steadily—thirty—forty—fifty—sixty—sixty-five—seventy feet; deeper already than he had expected; and so on to eighty feet. It took ten minutes to let him go so far, anxious minutes, prolonging the danger of attacks by sharks.

At last the hose stopped playing out, and a tug at the signal rope caused Nick Anagnos, who held one end of it, to call out, "Bottom!" with obvious relief. The man who had taken his place was now relatively safe.

Only relatively safe, for the life of a deep-sea diver is at all times hazardous.

Ready to Run the Gauntlet of Deadly Man-Eaters

Sharks or no sharks, Captain Cocoris doesn't believe in wasting ideal weather for gathering sponges. The photograph shows him just before a dive. He counts on his grotesque diving togs to scare the sharks away, and, in case this fails, on the knife which always hangs at his belt

If the air pressure slackens or is allowed to escape altogether, through failure of the pump to work or some other mischance, the weight of water may easily crush the life out of the imprisoned diver. If his air hose is fouled so that fresh air is cut off, or so that water can get into the helmet, the choice between suffocation and drowning is very slight. And if his system is not strong enough to stand the air pressure, he may suffer heart failure, or paralysis due to clogging air bubbles in the arteries, or a sudden attack of compressed air disease, "the bends," as the deep-sea divers call it. As he was now working in a pressure of about fifty pounds, sharks weren't the only danger.

"HOW often do you have trouble with the air supply?" I asked the pump man, on whose faithfulness Cocoris' life depended.

"Not very often, God forbid," he replied. "Once I was down there and the air stopped coming."

"What happened?"

"Pump jammed."

"No, I mean—happened to you?"

"I felt big head—sing in the ears, lung hurt sharp. I pull on the rope—know nothing any more till I was in hospital. My face it got black. Pretty near die. Can't dive any more long time."

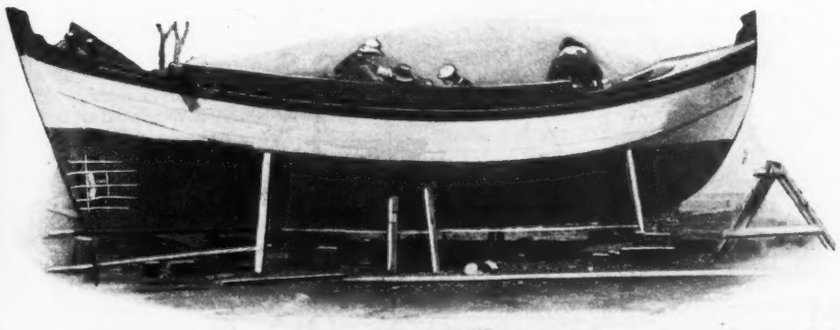
We watched with keen interest the indications of the Captain's path along the floor of the sea. The trail was marked by little linked chains of bubbles, rising in time with his breathing, and as he walked along we kept the boat somewhere nearly over his head by following the bubbles.

The first net of sponges was a bit slow coming up. Possibly they did not happen to grow very thickly there, or were concealed in masses of coral or seaweed. Again he might be making a selection as to size and quality. The law forbids the gathering of sponges under five inches in diameter, which works small hardship on the sponge fishers, as a sponge but little over that size is worth hardly a tenth of what it will bring after another year's growth.

At last, however, Cocoris "made it, three times, signs on the rope," and they drew up a net of sponges.

THEY were odd-looking things. The familiar sponge of daily use is really only the skeleton of the living sponge. Those I now saw were brownish and mushroom shaped, covered with a skin, and filled with a gelatinous substance like a jellyfish. The familiar large holes proved to be openings to tubes lined with skin, while the smaller openings, or pores, were also skin lined.

Simple as the sponge appears to be, it is a rather complicated animal. Through the smaller openings, or pores, the sponge sucks in water bearing food particles and oxygen. In a central digestive chamber the food particles are retained, and the rest of the water is then forced out again through the large openings. The current in and out is maintained by means of tiny fibers in the larger channels which move always back and forth, pushing the water out, and drawing (*Continued on page 138*)



The Sponge Divers Are Their Own Boat Builders

Because most of the Florida sponge fishermen are Greeks, even the "trehadire" (sponge boat) is modeled on the boats of the Aegean Sea. These graceful ships make an exotic sight on our coast

Are You a Quick Thinker?

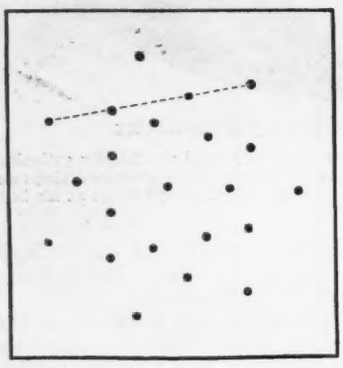
Try These New Brain Tests

They'll Tax Your Wits and Measure Your Mental Agility

SAM LOYD, the world's greatest puzzle expert, presents on this page six unusual tests with which you may measure your powers.

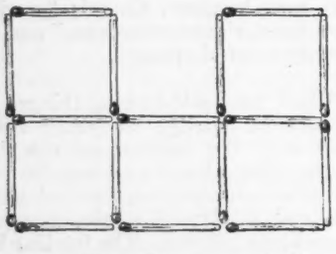
In their mental tests, psychologists often use blocks, triangles, numbers and squares which they ask you to juggle about. Now these, as every one knows, long have been the puzzler's tools. No doubt you have done puzzles and found that they oil your mental machinery and keep it from sticking when needed most.

By selecting a certain type of puzzle and setting a time limit within which it is to be done, Sam Loyd gives puzzles new value and they become a test of your mental abilities. You will find the problems on this page more difficult than the conventional mental test, but also more challenging. The answers are given on page 139.



Have You Sharp Eyes?

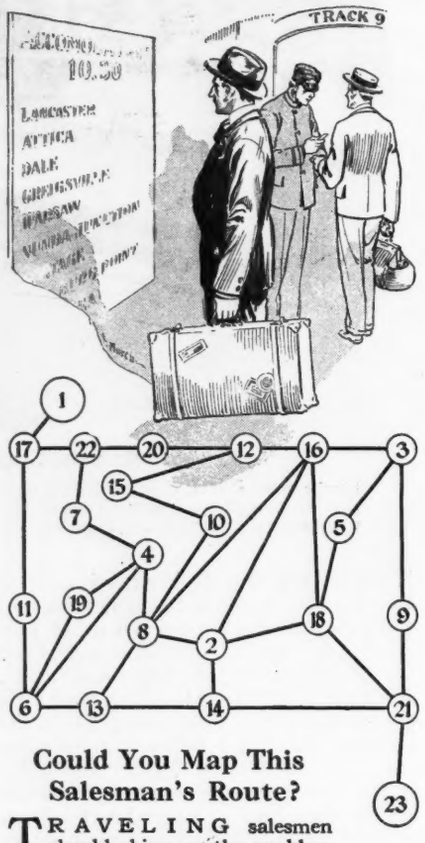
HAVE you an eye for form? Above is a group of dots with a straight line through four of them. How many similar rows of four dots can you find in the figure? In each case, the four dots must be in a straight line. Use a pencil if you wish and note how long it takes you to count all the rows. As a slight hint, your result should be a handsome geometrical design. For the answer, turn to page 139.



Are You Resourceful?

STUCK on a muddy road, some men always find their inherent inventiveness comes to the rescue. Do you possess this gift?

Here you see five squares made with matches. Pick up three matches and replace them so that the new arrangement will present four instead of five squares, of the same size. If you possess an inventive bent, you will see the solution quickly. Time yourself; then turn to page 139 for your rating.



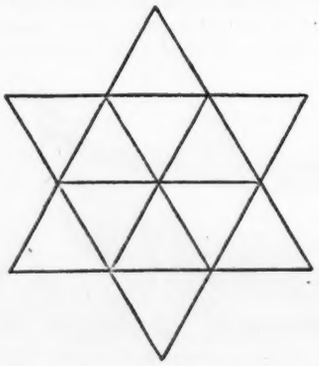
Could You Map This Salesman's Route?

TRAVELING salesmen should shine on the problem above, for it confronts them often. Solving it saves them both time and money.

For the purpose of the test, imagine yourself a salesman and that the diagram shows 23 towns you must make on a single trip. Starting from town number 1, you want to visit each of the towns, but without doubling on your trail, and ending at town 23. What would be your best route?

If you can visualize this tour after a six-minute study, you will prove that your powers of analysis and mental photography are well geared. Use a pencil if you want to. The solution appears on page 139.

Some Look, But See Little



HOW many triangles do you actually see in the six-pointed star pictured above? Of course there are twelve little ones, but there are others, too. See how many you can find within three minutes. See page 139.

2	9	5	6
15	7	16	3
12	14	10	11
8	4	1	13

If Your Forte Is Figures—

AT ADDING and subtracting you may be a whiz, and here is a chance to prove it. The test above shows sixteen squares containing the numbers from 1 to 16, and across it a light, straight line. You will notice that this line passes through seven of the squares, and adding up the numbers in those seven squares you will find that they total 69. Where would you place a straight stroke across the diagram in order to score the highest possible total? See if you can obtain the correct answer (see page 139) within seven minutes.

Do You Shy at a Column of Digits?

$$\begin{array}{r} 1 \\ 23 \\ 45 \\ 67 \\ 89 \\ \hline 99 \end{array}$$

HERE is another puzzle to show if you have a head for figures. A glance at the addition problem at the left tells that the answer is wrong. But 99 is supposed to be the correct answer, and your problem is to rearrange the digits so as to make it so. Study the nine digits and see how quickly you can make them total 99. A person of mathematical talent should do this within five minutes. The answer is given on page 139.

Ten Ways to Roof Your House

The Good and Bad Points in Various Coverings, from Wood to Copper—Estimating Costs

By John R. McMahon

Courtesy Portland Cement Assn.

Asbestos Shingles

The above photograph shows how hexagonal style asbestos shingles are applied over an old wood shingle roof. The old roof supplies insulation. Square shingles of this material also can be obtained in a variety of colors

Courtesy Johns-Manville, Inc.

A Roof of Concrete Tile

The lower picture illustrates the approved method of laying concrete tile. Note the sheathing and special lath. Above, one of the many typical houses finished with this durable, heat-resistant and attractive roofing

"YOU MEAN to say that house isn't built yet?" I demanded of the young couple who had consulted me quite a while before on the desirable materials for a small home.

"I'll tell you what stopped us before we started," said Ellen. "The roof."

"The roof?" I echoed.

"Yes," she went on. "I happened to come across this line: 'A house amounts to a foundation and a roof.' Those words just haunted me, and I told Rob we ought to know more about the roof question before we went ahead."

"That line that worries you is a sort of epigram," I remarked. "It wouldn't always apply—say in a dry climate. But the roof is certainly important—perhaps even the chief problem in home construction—and it is a good thing to study it."

"This time I'll take notes," announced Rob, producing pencil and paper.

"The first point to decide," I told them, "is the slope or pitch of the roof. A lot of people go wrong by having too low a slope, thinking to save material, do away with useless attic space, make roof repair easier and so on. They forget the importance of a good watershed, whatever the type of covering. If the pitch is low it might as well be practically flat. Then you can put on a factory type of built-up roofing."

"What do you call a good slope?" asked Rob.

"SIX inches to the foot is right for all kinds of shingles, whether wood or other material. That means that for every foot run of the roof there is a six-inch drop, or rise, as you please. It is otherwise called one-quarter pitch and the angle is twenty-six degrees thirty-four minutes. Slate and tile need more slope—about seven inches to the foot. On the other hand, ready roofings and soldered metal sheets, tin, copper, zinc or the like, do not need more than an inch or two of slope a foot."

"I don't see why a roof has to be steep for shingles," observed Ellen.

"The reason is that the wind sometimes blows rain water under them so that it reaches nail holes and goes through. This happens especially when wood shingles are old, warped or loose, but it could occur with a brand-new roof of improper slope. Again, snow piled on a roof may dam up water and back it under the shingles. Apart from leakage, ice may form under the shingle edges and pry them loose. The wind even may lift shingles. But these things can't happen when the roof has a good slant."

"I understand that a roof has to be stronger for some materials," said Rob.

"Naturally. Tin or copper will weigh around a pound to the square foot while tile will weigh seven pounds or more. The ordinary roof will stand asphalt or wood shingles, the latter weighing around two and a half pounds to the foot. But when you have asbestos shingles at four pounds or slate at five pounds to the foot, not to mention tile of burnt clay or of concrete, the roof should be designed to take care of the additional load. Incidentally, weight of similar material differs according to thickness and style of laying. Find out the exact weight of the stuff you intend to use. If at the last moment you decide on a heavy covering and are in doubt as to roof strength, put some studs under the ridge, insert bridging between rafters, tie opposite rafters together with cross boards, also brace rafters down to ceiling beams."

"What about wood shingles?" inquired Ellen.

"They are liked for looks and economy. They are banned by many cities because of fire hazard, especially because burning shingles fly around in a breeze and tend to spread conflagration. There is less fire danger with edge grain shingles that do not warp and rot like flat grain. Of course their upkeep is also less. Wood shingles sometimes are bent to form the intriguing curves of the so-called thatched roof—beautiful, but rather costly to produce. It's done by suitable framing of the roof and by using factory-bent shingles for the deeper curves. When color is added to the wavy lines of the thatched style, you have a stunning combination. These shingles are treated with both color and creosote at the factory."

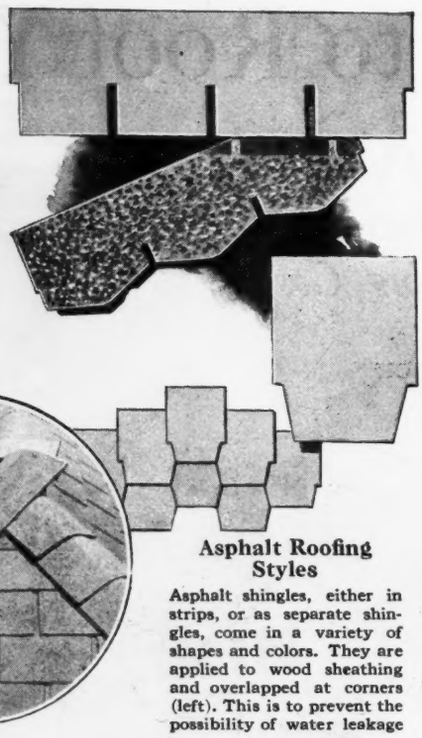
"I'VE seen men dipping shingles in some kind of dope at the job," remarked Rob.

"Yes, often the exposed ends only,

Tacked on in Strips

Asphalt shingles, a comparatively recent arrival in the roofing field, cost about the same as wood. Mineral surfacing also lessens fire danger

Courtesy Flintkote Co.



Asphalt Roofing Styles

Asphalt shingles, either in strips, or as separate shingles, come in a variety of shapes and colors. They are applied to wood sheathing and overlapped at corners (left). This is to prevent the possibility of water leakage

which is not so good. Creosote preserves the shingles and should be applied to the roof every four or five years. I know a man who sprinkles a little lime on a wood shingle roof. Says it keeps down moss and other fungus which may rot the wood. He may be right. And this reminds me to warn against originality in shingling methods. Don't try to improve on the old style by putting sheathing boards beneath. When shingles are rain-soaked they need ventilation below so as to dry out and not decay. That's why they are applied merely on strips—called shingle lath—which are nailed crosswise on the rafters every four or five inches. It's the unavoidable defect of a wood shingle roof to be more or less drafty and cold in winter, and to become rather hot in summer. You can't insulate it."

"NOW that we know the worst," smiled Ellen, "what are the best kinds of wood shingles?"

"Cedar, cypress and redwood. Common sizes are sixteen and eighteen inches long, random widths, about quarter-inch thickness at the butt and half as much at the slim end. Of course heavier grades are better and the laying should insure at least a triple lap, or three thicknesses of material, at every point. With sixteen-inch shingles about four and one-half inches are usually exposed to the weather. It's important that every shingle should be fastened by at least two nails, and these copper if you can get them. While you are investigating the various styles of wood covering, you might look into a novelty called cedar tile. It is an extra thick, long shingle with side joints in ship-lap style and with shallow grooves on the top edges to carry off water, among other purposes. As with other sizable units, cedar tile afford the light-and-shade that is pleasant to look at."

"Are asphalt shingles any good?" asked the young husband.

"They're a useful product, too," I replied. "They are applied usually over tight sheathing and can be insulated beneath with anything else you want to add. The cost is about on a par with wood shingles, that is, four to eight cents a square foot for the material without cost of applying. Roof estimates, you may know, are always in units of 'squares,' each being one hundred square feet."

"Asphalt shingles are no more fireproof than wood, are they?" inquired Rob.

"Well, the tarry stuff that binds the layers of fiber together will certainly make a cheerful blaze. But if it is well surfaced with mineral that stands the weather, chimney sparks won't ignite the top. Again there are kinds in which the fiber layers, instead of being inflammable material, are sheets of asbestos. These will retard if not stop a fire breaking through from below. Try a blowtorch on a sample; the asphalt melts out but it is difficult to burn a hole through. You can get asphalt shingles either in separate units or assembled in strips that are more quickly put on. There are a number of colors between green, gray and red. It's all right to select a nice color, but I would be more interested in having a shingle of good quality and thickness, as rigid as possible, and with a mineral surfacing that promised not to wash off in the first few rains."

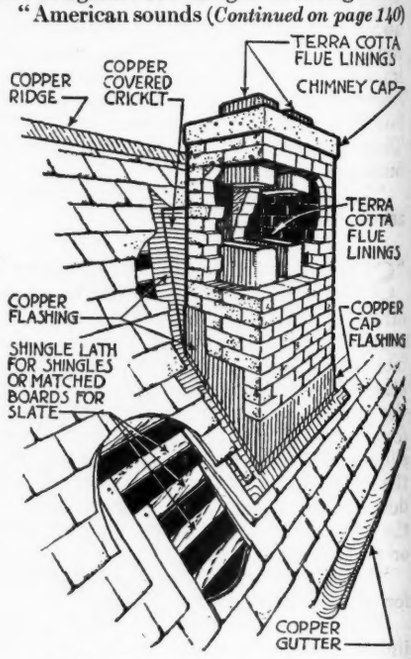
"JUST what are asbestos shingles?" asked Ellen.

"They are partly what their name says and the rest is Portland cement, a moistened mixture of two natural stones that is compressed to form a new stone. They are absolutely fireproof, harden with age, do not warp, curl or decay. They cause no problem of chemical action as do some other roofings. Their medium weight does not call for extra strong framing beneath. You might compare them with slate, which they resemble in natural make-up and otherwise. It is a complaint against inferior brands that they are too brittle, and some seem to be too light because of excess of asbestos or some other reason. The better sort are made under heavy pressure and are properly cured, which is the main secret of every good cement product. Besides the smooth surfaced asbestos shingles, we now have rough or corrugated surfaces for the upper parts exposed to the weather. Of course this is a matter of looks which I would pass up in favor of the smooth face's better watershed.

"These shingles come in various colors: red, green, brown, mauve, gray and a few other colors between. You can have any one of these, or a combination in a formal pattern, or, best of all, a seemingly chance mixture of tones that give the effect of autumn leaves. Such a roof ought to harmonize with the walls of the house. For example, it would hardly do to have a giddy top on a white colonial dwelling, while a home of brick or tinted stucco might be suitably adorned by a colorful covering. I would get an architect or artist to advise on the proper combination.

"ASBESTOS shingles are made and laid in two principal styles, American and hexagonal. American is rectangular like the common wood shingle, is lapped to make at least double thickness, and has two ready punched nail holes for fastening. The fire underwriters give a rating of Class A to these shingles in the American method while they only award B to the hexagonal style. They prefer the American for its double thick layer of material, which totals at least one quarter inch, and because of its staunch fastening. Hexagonal is mostly single thickness, being lapped only on the edges. A square foot of American weighs about five pounds compared with three pounds for hexagonal, which is just the difference between the quantity of material used, the thickness of individual shingles being the same. To put it another way, with foot-square size in American it requires 240 shingles to cover a square or one hundred square feet as against 160 shingles in hexagonal."

"American sounds (*Continued on page 140*)



Vital Points in Roof Building

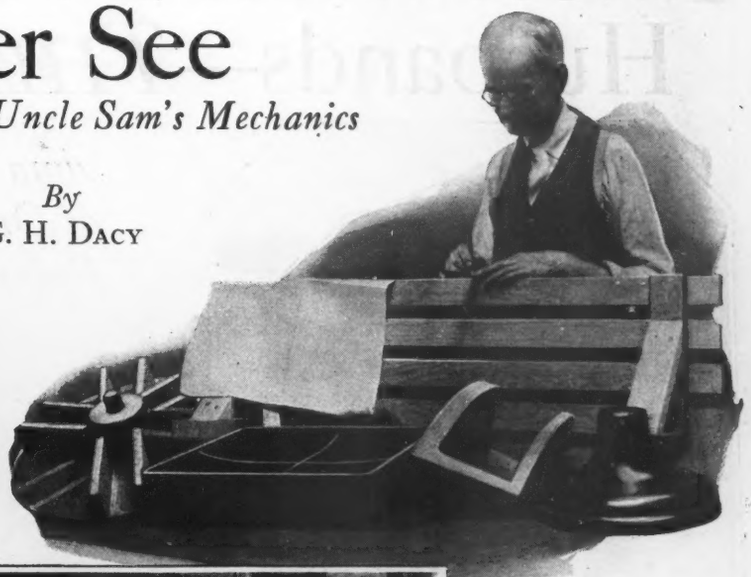
If you want your house to be perfectly dry and safe from chimney fires, pay special attention to details shown in this drawing

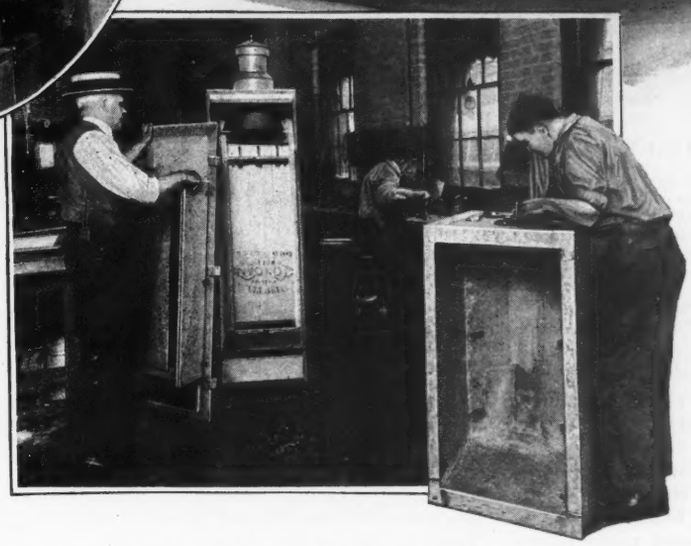
Inventors Whose Odd Devices You Never See

No Job, However Strange, Stumps Uncle Sam's Mechanics

By
G. H. Dacy

Above: Electrical experts of the mechanical shops putting the finishing touches to an electric lamp flasher needed by a Government scientist for testing plant growth under artificial light—one of many devices made yearly





There's no telling what strange device the mechanical wizards of the Department of Agriculture may be called upon to invent. These devices form the bases of scientific experiments by which the Government saves us millions yearly. Above: Making wooden patterns and models for Uncle Sam, master farmer

Left: A sterilization cabinet for freeing imported and domestic plant bulbs of disease, and a constant-temperature cabinet for studying the effect of light on plant growth, which were recently originated in the Government shops

NO OTHER group of mechanics in the world, probably, is brought face to face with such a variety of perplexing tasks as the 139 men in the mechanical shops of the U. S. Department of Agriculture at Washington. Not only is a high quality of technical skill required of these men, but each of them must be an inventor; for virtually every day will come a call for the shop to produce some mechanical appliance that never before has been made.

What the mechanical shops actually do is supply the experimental equipment for more than 5,000 scientists who are constantly studying problems connected with the farming world. These problems cover the range of soils, livestock, crops, bacteria, fungi, dairy products, road materials, seed, bird life, trees, insects, hides, wool, cotton, fruit, and vegetables.

This research has been worth millions to American agriculture. In some instances, the discoveries of the Government scientists have revolutionized farming practices throughout the world. And in every case the blacksmiths, machinists, cabinetmakers, electricians, designers, draftsmen and pattern and model makers in the shops have played an important part.

One scientist may be working on a problem of soil fertilization. Though he knows the results he seeks, he does not know how to build testing devices. But he can pass his problem along to the mechanical shops in full confidence that it will be solved.

Perhaps one day they must devise a contrivance to harvest a crop they have never seen. A day later, they are requested to make a machine for curing and grading curious seed from an African forage crop. The next assignment may be to perfect equipment for testing raw wool, or a device for measuring the acidity of soils.

Recently at the mechanical shops I saw a curious metal cabinet so devised that the temperature and humidity within it could be controlled by electrical heaters and refrigeration so that the effect of these factors on plant growth might be studied.

Another metal tub was being fitted with electric immersion heaters and a water circulation system for the sterilization of diseased plant bulbs. The infested bulbs were to be placed in the sterilizer and subjected to a certain constant temperature long enough to kill all the pests.

THEN there was a large experimental seed drier made of sheet iron heated to a temperature of 115 degrees under thermostatic control. An electric fan circulates the air in the dryer. There is a damp air outlet at the top and a dry air intake at the base. The seed is placed in trays in the cabinet, and the moisture is quickly evaporated.

A handy little device for measuring the annular rings of tree growth was perfected to aid in the study of parasite ravages of trees. In studying the damage worked by the pests, it was necessary to take 300 or more measurements on trees which were about 100 years old. The small tree growth yardstick facilitated this test.

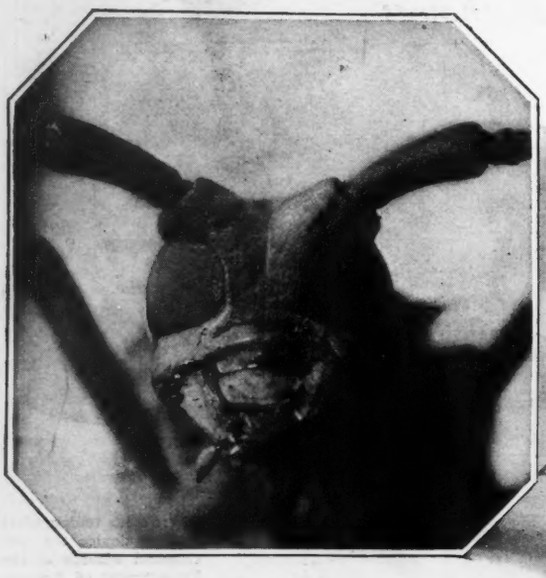
Another scientist was surveying the growth of destructive bacteria and fungi at varying temperatures. By the use of electrical heating coils and brine refrigerant for regulating the temperatures in eight different temperature compartments built by the shops, he was able to ascertain the growth of the germ culture at each temperature and at what point the disease made its greatest development.

UNCLE SAM is director of Center Market, the largest market in Washington. Recently, the mechanical shops completed twenty-five meat display show cases for use in this market. These stands are glass enclosed and are equipped for sanitary refrigeration. Each display case is supplied with refrigerated brine without the use of unsanitary piping directly in the compartment where the meat is exhibited. The system (*Continued on page 138*)

Insect Wives Don't *Coddle* Lazy Husbands—*THEY KILL THEM*

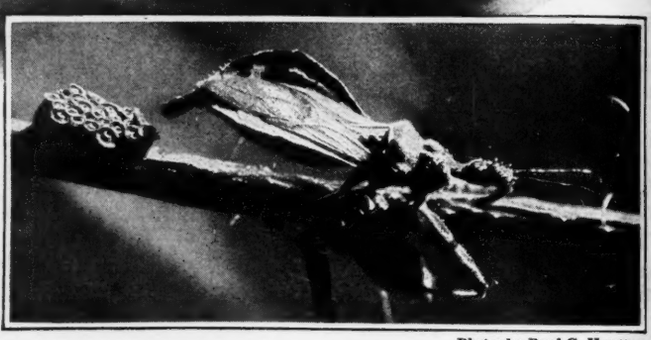
Amazing Tales about the World at Our Doors Where the Female Rules with Ruthless Efficiency

By ROBERT E. MARTIN



The Look That Kills

Insects get quite as petrified at each others' frightful visages as we do when we see human monstrosities. The face of the Japanese beetle above, in fact, is one of his best weapons



Pouncing Upon Its Prey

Above: A highly magnified photograph of an insect dragon—the Rove beetle—ferociously attacking a fly. Right: An Assassin bug in the act of laying its bottlelike eggs. This bug inflicts a stinging bite, and won fame a score or more of years ago as the "kissing bug"

Photos by Paul G. Howes

THE other day a man told me of one of the most cold-blooded massacres imaginable, even among the wildest savages. It happened in a hive of bees—one of those marvelous apartment houses designed by master craftsmen of the insect world.

It was summer. Throughout the long, hot days there had been endless hustle and bustle in the big house—rooms to clean, more rooms to build, many babies to nurse, dinners to provide, and pantry shelves to be stocked. It had been an exceedingly busy summer—busy, that is, for the women of the house; they had done all the work. While they worked, the men folks had spent a lazy vacation, lolling in the sun, eating and drinking, carousing in the hallways, and making a nuisance of themselves generally.

At last there came a day when the womenfolk rebelled. Their patience was exhausted. They served notice that all the good-for-nothing men must go.

THIS was no mere rolling-pin indignation meeting. These females meant business. Suddenly, as though at a given order, they set upon the lazy gluttons and murdered them to the last man!

Now you may think that this tale of atrocious slaughter is only an insect fable; or, at best, an account of one unusual happening. Yet any authority on entomology will tell you that it is not extraordinary. Rather, it is typical of countless atrocities committed every day in the busiest and most competitive world in all creation—a world where every creature must work or die.

Life among the insects is more grueling than man ever dreamed of. In all, there are some 200,000 different kinds of them. They are found everywhere—in the air, on the ground, beneath the earth, and in the sea. In the battle for their lives and for the lives of their young, they are relentless. Even the loveliest of them are vandals and robbers. Many of them are cannibals. Some, like the bees, are murderers.

And yet, with all their ruthlessness, the insects are startlingly like human beings. They have feelings. They see and hear and smell. It is possible, even, that they talk in languages which we cannot hear. They woo and mate, build homes and rear families. The cleverest ones of all, the ants, cultivate gardens, keep servants, entertain guests, and support standing armies.

IN ONE surprising respect the insects go us one better—if you look at it that way. That is the fact, strikingly illustrated in the story of the bees, that their world, as a rule, is a world where the women do the work and the men count for little. The females are not only the mothers, housekeepers and nurses; they are the masters. They are the artisans, craftsmen, laborers, warriors and captains of industry. The chief destiny of the males, it seems, is to mate and die.

To this rule, however, there is at least one notable exception—the dumpy little scavenger beetle known as the sisyphus. In this tribe the father and mother work side by side in the task of providing for their family.

A NATURALIST who watched closely one of these devoted couples at work tells how they prepare and transport food. First, with cleaverlike tools on their front legs, they cut away a neat chunk of refuse on which they feed. Then they pat and knead it gently, forming it into a sphere of marvelous symmetry. This done, they roll the ball to give it a crust. On one side the mother, clutching the ball with her front legs, moves backward, hauling it toward her. On the other side the father, upside down, pushes with his hind legs.

There ensues a remarkable journey. Charting the course of the ball in a straight line, Mr. and Mrs. Sisyphus refuse to be swerved by any obstacle. Whenever they come to an obstruction, instead of going around, they tug and push until they get the ball over. Time and again the ball gets away from them, tumbling them head over heels. Always they scramble up again and keep on rolling.

Finally when the ball has been rolled enough, the mother goes off in search of a

good spot to deposit it in the earth. The father stands guard. He amuses himself spinning deftly the sphere with his hind legs, like a professional juggler, with an air of satisfaction at the cleverness of his work.

Contrast the peaceful existence of these creatures with the terrific marital upheavals in the life of the praying mantis, or devil-horse, cousin of the grasshopper. The female mantis is worse than a tyrant; she is a cannibal and a female Bluebeard. When she tires of a husband she devours him. She has been known to dispose of seven mates in this manner, one after another.

IN FACT, the mantis is the fierce ogre of insectland. You may find her by the roadside in late August, lying in ambush. She dotes on raw meat, especially bees, wasps, and grasshoppers. In one morning a single female mantis has been seen to devour three grasshoppers and a grandaddy-long-legs, finishing off the meal with a fellow mantis.

The praying mantis derives her name from the fact that, while lying in wait for her victims, her hinged body, the fore part of which is like the neck of a giraffe, has two long arms that are folded in an attitude of prayer.

Actually these arms form a living trap from which no victim can escape. They are edged with needle-pointed saw teeth and each is tipped with a strong hook fitted with a blade like a pruning knife. Let another insect come within striking distance and the arms shoot out, the knife points pierce and tear, and the victim is crushed between the saw blades.

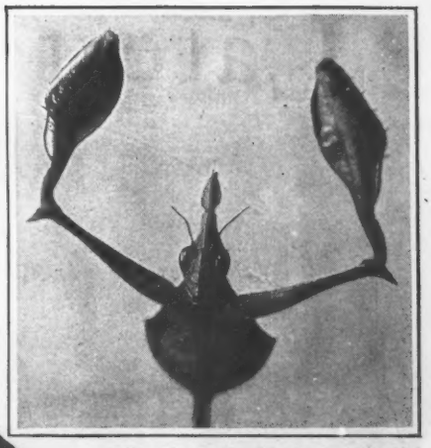
The mantis is gifted, too, with a strange sort of hypnotic power. A grasshopper approaches a little too close. At the sight of her prey, the mantis, with a startling convulsive movement, spreads her gauzy wings like a fan. Her body writhes with a swishing sound. Rising to full height, she rolls her head from side to side and stretches out her arms. In a moment she is transformed into a terrible specter. The grasshopper stands petrified, its legs too weak for a jump to safety. Slowly the mantis advances. The talons strike, and the career of the grasshopper is ended.

SUCH is the insect tigress. Strangely enough, by destroying destructive pests, she is one of man's best friends. Such a friend, too, is the ferocious gardener beetle which runs wild in its greed for caterpillars.

Fabre, the great French naturalist, once determined to find out just how murderous these meat-eating insects could be. He placed twenty-five gardener beetles in a small pen. Into the same pen he led a procession of 150 caterpillars. In a moment the place became a slaughterhouse. No sooner did the beetles spy the intruders than they pounced upon them viciously, slashing and wounding them with their sharp jaws. Within fifteen minutes the massacre was complete. The entire army of caterpillars was exterminated—six victims for every beetle.

Many insects have developed ingenious methods of attack and defense. Some of them build deadly traps. The tiger beetle, for example, digs a perpendicular hole and uses its own flat head as a deceptive trapdoor. When an insect steps on the door it instantly tips up, and the victim falls headlong into the pit. The ant lion, too, designs an inclined chute in the ground. Whenever an ant slips down the chute, the lion stones it to death, hurling the missiles with its neck as a catapult.

Others are armed with fearful weapons. Most of us can testify to the effectiveness of the poisoned darts with which members of the bee family attack creatures many times their size. The wasps, for instance, are the lightweight champion in battle.



The Mantis—Not in Prayer

The praying Mantis, cousin to the grasshopper, is so-called because she waits for victims with arms folded as if in prayer. When a victim appears, her arms shoot up, ready to strike

A "Rhinoceros" Less than Three Inches Long

This is the rhinoceros of the beetle family, found by George M. Dyott on a South American expedition. It measures two and one half inches, including the horns

ONE observer tells of witnessing a combat between a lone digger wasp, on a hunting expedition, and a cicada, or seventeen-year locust, four times her size. Scenting her prey, the wasp swooped down to the attack. As the two tumbled to the ground amid a buzz of wings, the wasp stung the cicada in the back of the neck. The effect was paralyzing. The cicada fell limp. To carry the catch home, the wasp first dragged the victim part way up a tree and from there volplaned with it for a short distance in the direction of her burrow. By repeating this process several times, the huntress finally reached her destination.

However, insects by no means spend all their time fighting and killing. Probably the most fascinating thing about them is their skill as architects, builders, engineers and manufacturers.

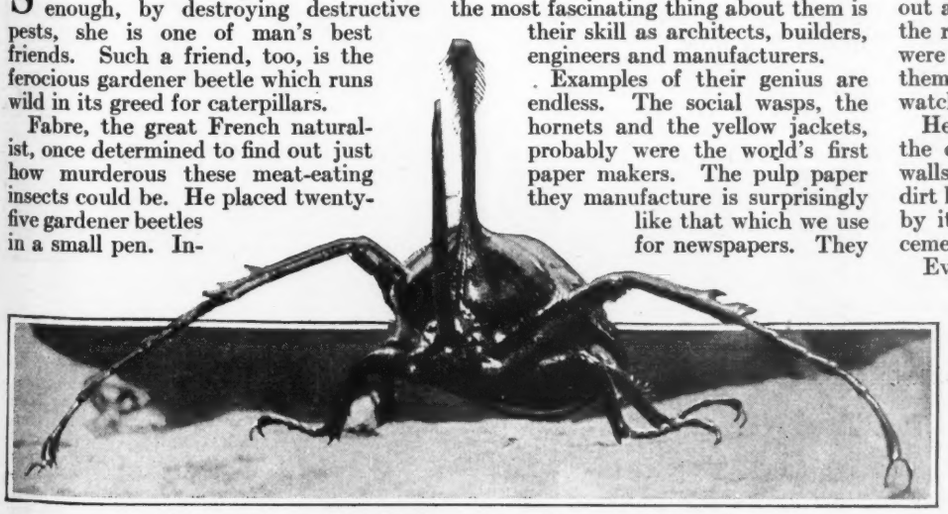
Examples of their genius are endless. The social wasps, the hornets and the yellow jackets, probably were the world's first paper makers. The pulp paper they manufacture is surprisingly like that which we use for newspapers. They tear off bits of wood fiber, chew it into a pulp, and use it for weatherproof nests. The bees are expert mathematicians and architects. Any human engineer will concede that the design of the bee's delicate six-sided honey cells, with walls of wax a hundredth of an inch thick, cannot be excelled for strength and economy of materials.

AS A tunnel builder the stolid grub of the seventeen-year locust, or cicada, might give lessons to human diggers. In climbing to daylight after its long sojourn in darkness, this little grub excavates a tunnel more than a foot long and nearly an inch across, without throwing out an ounce of dirt. What becomes of the rubbish? For a long time scientists were at a loss for an answer, until one of them put a grub in a glass tube and watched it dig its way upward.

He discovered that the insect converts the dug earth into cement to line the walls of the tunnel as it goes. It digs the dirt loose, mixes it with a liquid supplied by itself, and finally pounds the mixed cement into the tunnel wall.

Even our familiar cricket is a master builder. In the art of constructing a home it is exceeded only by man. It digs in a grassy bank an abode that is a model of neatness. And throughout life it is constantly making additions and repairs. Every cricket home has a front porch in the form of a tuft of grass that shades the entrance, and a terraced front yard that is kept carefully raked and swept.

At the threshold, the cricket sits and plays its fiddle (*Continued on page 142*)

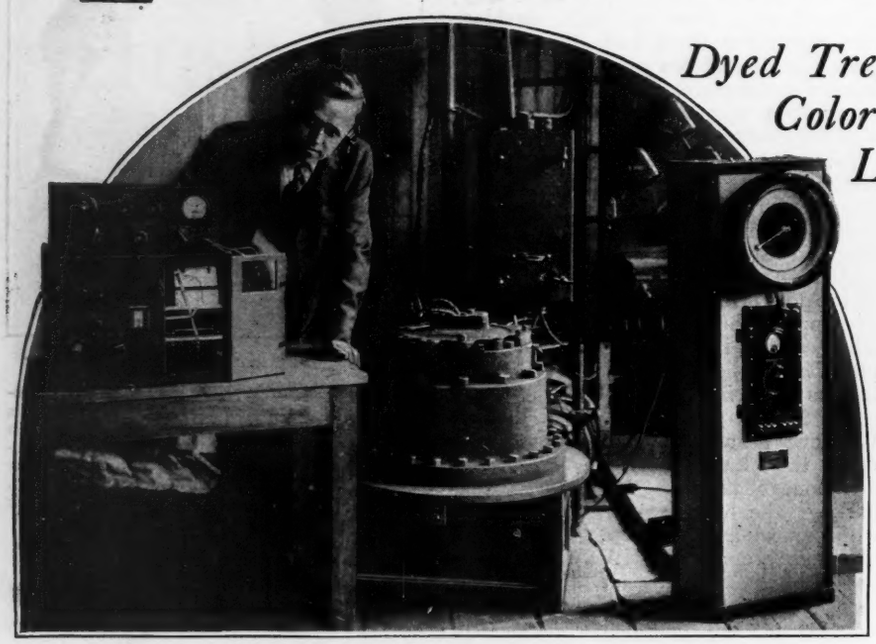


This Beetle Is a Fast Walker—Once He Learns How

Another monster of the beetle tribe, photographed by Mr. Dyott on his South American trip. The horns, the long front legs and its unusual size make it a foe to be treated with respect

Latest Marvels of Science

Dyed Trees Amaze Woodmen—Color Filters to Dim Auto Lights—Other Novelties



Sound Echoes Tell Navigators the Ocean's Depth

Ships crossing the sea now can literally "feel" their way, since the invention of a new depth-measuring apparatus by P. T. Russell, of the Washington Navy Yard. The apparatus sends out sounds from the bottom of the ship, and the speed of the echo returned from the floor of the ocean indicates the exact depth. Amplifiers transmit the sounds to the navigator. Above: Mr. Russell with (left to right) the sonic depth finder, sound transmitter and sound receiver

On these pages are presented each month brief stories of scientific discovery and research having practical bearing on our every-day problems.

Physicians Trace Rheumatic Ills to One Small Bone

RHEUMATISM long has been regarded as a more or less harmless, though often painful, affliction. Today, however, medical men who have made a special study of the disease are convinced that what is commonly classed as "only rheumatism" may actually be any one of a number of serious nervous disorders.

Some remarkable discoveries recently were made by Dr. Henry P. De Forest of New York City and Dr. Horace G. Baldwin of Tannersville, N. Y., who have been engaged in extensive researches at the Cornell University Medical Laboratories. They found that nervous prostration, neuritis, diabetes, sciatica, lumbago, neuralgia and various forms of painful affections generally classed as "rheumatic," are due to mechanical nerve irritation, and that the seat of this irritation apparently lies in a joint at the base of the back where the pelvic bones are joined.

They have demonstrated, apparently, that a slight dislocation of this bone exerts pressure on the nerves passing through the joint, causing pain in the foot for one man and perhaps headache for another. By setting this little bone in place, they claim to have brought relief to sufferers.

He Colors Trees to Order

WHAT color would you like your trees—blue, yellow, pink, or orange?

Woodsmen in the vicinity of Machias, Me., have been astounded in recent months at the magical experiments of Fritz von Behr, German scientist, who has been coloring trees with indelible dyes. By means of a secret process, he can transform an ordinary beech tree into "rosewood" and birch into "mahogany" which are said to defy detection by expert lumbermen and furniture manufacturers.

The coloring matter saturates the trees from the outer surfaces to the hearts of the trunks. In the process, holes are bored at the base of the trunk, and these serve as reservoirs for the dye. Many articles have already been made from this colored wood.

To Foretell Earthquakes?

ONE of the most important of recent advances in the science of forecasting earthquakes is a little annunciator almost as simple as the ordinary house thermometer. It is the invention of Dr. Thomas A. Jaggar, Jr., government volcanologist, who declares that it will "soon enable us to foretell the coming of serious earthquakes as accurately as the approach of typhoons has been made predictable in the Philippine Islands, where similar instruments have predicted the coming of typhoons to the hour and minute."

The instrument is in two parts, one part being a simplified seismograph, to be located in the basement, and the other part an indicator, to be mounted in any convenient part of the building.

New Instrument Robs Higher Mathematics of Terrors

MORE and more we are making "mechanical brains" do the work of solving our mathematical problems. Adding machines were the first of these.

The latest is an instrument known as the "plane trinometer" which, it is predicted, will greatly simplify the work of engineers in making their calculations, and may even revolutionize the entire study of higher mathematics. It is the invention of Dr. Joseph E. Rowe, head of the mathematics department of William and Mary College, Williamsburg, Va.

Among the operations which the inventor claims his instrument will perform

World's Most Powerful X-Ray Machine

Two rooms are needed to hold this powerful X-ray machine, installed recently in the Long Island College Hospital, New York. Patients are protected by a control board, shown above, that directs the radiation and indicates the exact length of waves that they are receiving. Left: A patient undergoing a treatment of rays from this powerful machine

and Mechanics

are the automatic solution of triangles in surveying; finding the area of such triangles; solution of all sextant problems, such as finding the height and distance of a visible object without computations; rapid solution of trigonometrical equations; and range findings on land or sea. It can be used also for multiplication, division, raising any number to any integral power, extracting square roots, and other problems.

It's Phosphorus Keeps Us Alive

WHEN you strike a sulphur match, oxygen is set to work on phosphorus, producing heat.

Exactly the same thing happens in the human body, declares Dr. C. E. De M. Sajous, professor of endocrinology at the University of Pennsylvania. Phosphorus is present in our cells, he has found, and oxygen acting on the phosphorus releases the heat that maintains the temperature of the body. In fact, after twenty-five years of research, he asserts that this action is the very source of life.

He explains fever by the same theory. As the heat is produced, a bodily fluid known as enzyme is built up. The job of the enzyme is to digest germs. When disease attacks the body, the temperature is increased to multiply the enzyme. This increased heat is known as fever. When the temperature reaches a certain height, however, the enzyme becomes so active that it digests the human tissue as well, and death results.

Blue and Orange Auto Lights May Dim Headlight Glare

THE dangers of glaring auto headlights, which are only partially removed by dimmers and special lenses, can be eliminated entirely by the simple use of orange and blue colored filters, according to Karl D. Chambers, of Asheville, N. C. He demonstrated his proposed color system recently before the Society of Automotive Engineers.

According to his ingenious plan, the filters would be adjustable so that on cars traveling in one direction on a highway the headlights would give blue light and the drivers would look through blue filters attached to the windshield. On cars going in the opposite direction, the colors of the headlights and filters would be orange.

Since a colored glass filter passes light of its own color, but stops that of a complementary color, and since blue and orange are complementary colors, the result would be, Chambers declares, that drivers going in either direction would have perfect visibility.

Helium As a Cure for "Bends"

THE noninflammable gas helium, used for the inflation of airships, has been the means of safeguarding the lives of men in the air. Now it is being put to use to save the lives of men who work under the sea or beneath the surface of the earth.

When, a short time ago, one of the deep-sea divers working to raise the sunken submarine *S-51* was stricken by the dread caisson disease, or "bends," ten cylinders of helium were rushed from the Naval Air Station at Lakehurst, N. J. The precious gas saved his life. Since then, the Navy Department and the U. S. Bureau of Mines have been experimenting to determine whether the administration of a mixture of helium and oxygen for breathing purposes may not entirely prevent the disease which attacks men who work under high air pressure.

Caisson disease results from the fact that the human body is able to absorb only a limited amount of nitrogen in air under pressure. When, for example, a diver is brought to the surface and the pressure is released, the unabsorbed nitrogen forms bubbles in the blood. These bubbles cause "the bends" and sometimes result in death.

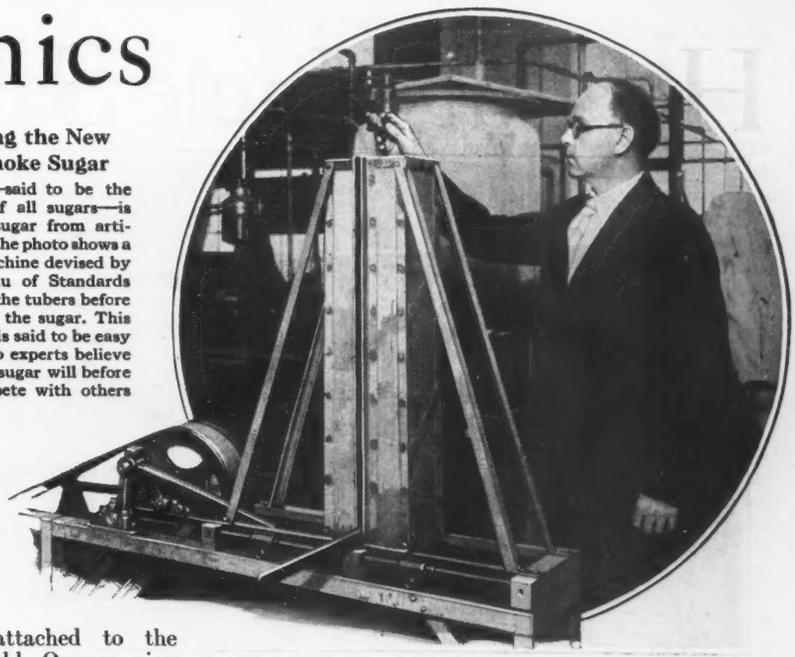
The advantage of a mixture of helium and oxygen in place of plain air is that helium goes in and out of solution in the blood much more rapidly than nitrogen. It is estimated that with the use of helium a diver can be raised to the surface in about one third the time required when air only is used for breathing.

Science Approves the Pie

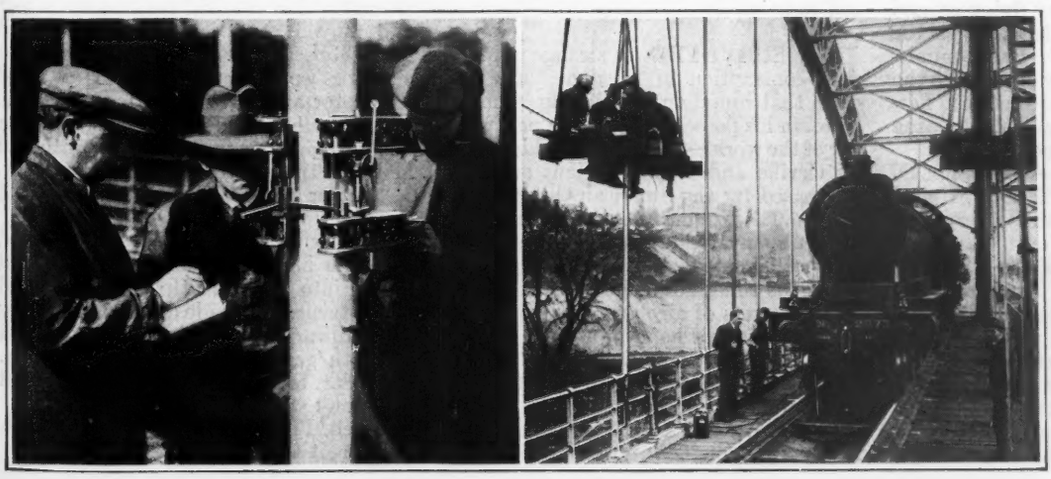
NEXT time you want pie for lunch, you can order a piece without fear of injuring your digestion. Food specialists of the American Medical Association tell us now that pie is not nearly so indigestible as we think.

Cake, too, is approved as a real food. The notion that cake is "too rich" is refuted, the experts say, by the fact that it has only twenty-five percent more calories than bread. A slice of bread and butter is almost twice as rich in fat as the same amount of chocolate cake.

Making the New Artichoke Sugar



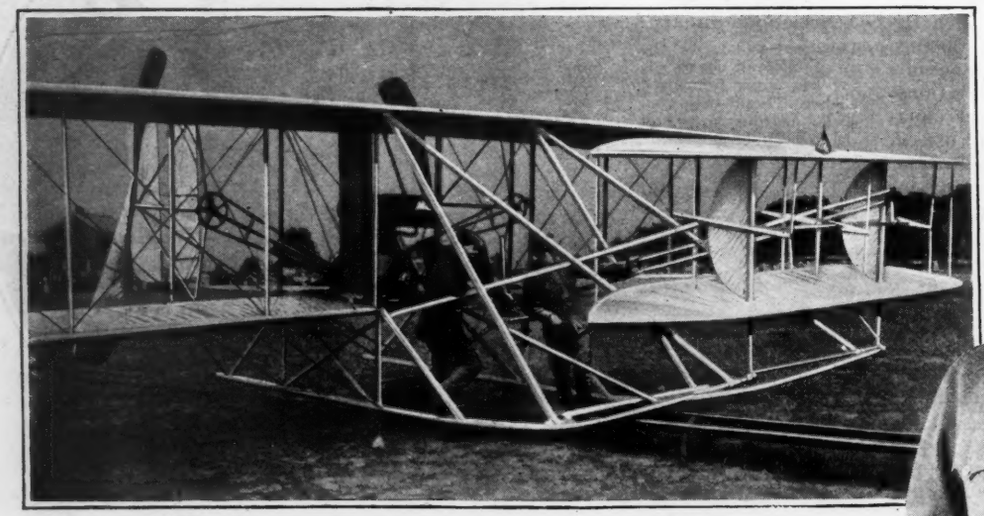
Levulose—said to be the sweetest of all sugars—is the new sugar from artichokes. The photo shows a slicing machine devised by the Bureau of Standards to cut up the tubers before extracting the sugar. This vegetable is said to be easy to raise, so experts believe artichoke sugar will before long compete with others



Gaging the Stress on a Famous Bridge

When you walk across a railway bridge while a train is flying past, you notice the tremendous vibration and wonder how the structure can stand. Sometimes bridges weakened under constant strain have caused serious wrecks. To measure the stress on bridges, delicate instruments have been devised. In the photographs, experts are taking such measurements on a famous bridge crossing the river Tyne in England, perching on a temporary platform around one of the steel bridge supports

He Put Uncle Sam *in the* AIR



The plane that made the test flight from Fort Myer to Alexandria in 1909, resulting in its purchase by the Government. Its passengers, shown above, were Orville Wright (left) and Foulois

Lieut. Col. Benjamin D. Foulois, who, with one ramshackle plane, constituted our entire air force in 1910. He wrecked the plane in trying to fly it, but his unflagging enthusiasm and vision insured the future of this important branch of our national defense

How Foulois, Our Army's First Birdman, Nursed a One-Man Flying Force to a Powerful Arm of Defense

By GEORGE LEE DOWD, JR.

ONLY sixteen years ago, incredible though it seems, Uncle Sam's whole fighting force in the air consisted of just one patched-up flying machine—in which the chances of breaking your neck were about fifty-fifty—and a lone pilot who didn't know how to fly it.

In that short span American airmen have proved themselves indispensable in war, and in peace have astonished the world with their feats. They have flown to the North Pole. They have circled the globe, crossed the continent without stop and the ocean without mishap, traveled at the amazing speed of three hundred miles an hour—in short, they have established the airplane permanently as a vital means of transport in peace as in war.

The man who more than any other embodies in his own person these epoch-making achievements is the man I visited the other day at the Army flying ground at Mitchel Field, Long Island. He is the man who, back in 1910, was commissioned to fly the first Army airplane—who didn't know how to fly it—but who flew it! He has been flying, and showing others how to fly, ever since.

He is Lieutenant Colonel Benjamin D. Foulois, Commanding Officer of Mitchel Field and of the Ninth Observation group, and during the World War Chief of Air Service of the A.E.F.

He is the real father of Army aviation —the first of all American air fighters. Time was when he alone, with a skittish plane that threw him to earth every few days, constituted all there was of the Air Service. And it was largely through his struggles and adventures in an unexplored science that soldiers found their wings, and that the art of aerial combat was nursed from a one-man experiment to a powerful arm of defense.

I found Colonel Foulois a man in his forties with the vigorous carriage of a youth. He holds his wiry body as straight as a die. His tanned, good-natured face, glowing with health, is undershot with a fighter's jaw. At his desk he works incessantly. And when he is not at his desk he is flying. He is a man of few words.

The record of this reticent fighting man is a story of romance, adventure and achievement. Its beginning would take you back to 1910, to a barren field in San Antonio, Texas, where stood a lonely young lieutenant, pondering with some misgivings the curt instructions he had received.

"Here is your flying machine," the orders said in effect. "Now teach yourself to fly it!"

HE SURVEYED a strange winged contraption of wooden sticks and cloth that rested on two sledlike runners. Here, in his possession, was the new wonder of the world—the flying machine built by Orville and Wilbur Wright and just purchased by the American Government for $25,000. And here was he, set down with the mysterious contrivance and a crew of eight enlisted men, and told to make the thing go in the air!

The secrets of airplane operation were known to only a handful of men at that time, and Lieutenant Foulois' actual flying experience had consisted of just ninety minutes in the air with Orville Wright at Fort Myer, Va., the previous year. Fortunately for the future of flying, however, he was a fighter of resourcefulness. Moreover, his imagination had been stirred by the study of aerodynamics and by man's attempts to master the air. He was familiar with the theories, if not the practice, of aviation. Now, told to "teach himself to fly," he recalled a parting word Orville Wright had given him.

"Lay aside your books," the inventor had said, "and lay your hands on the machine."

AND that is just what Foulois did. He walked to the machine, grasped one of the slender wooden struts, and felt its strength. He climbed to the pilot's seat and moved the "joy stick" back and forth, observing how the wings and elevators worked in response. He started the motor and watched as it whirled the two propellers behind the wings. Then he moistened one finger in his mouth and held it to the breeze. The wind was right.

"Let 'er go!" he shouted to the ground crew.

Shot by a catapult, the plane skidded along an inclined monorail and climbed slowly into the air. Up a few hundred feet it turned in a wide circle, and soaring down toward the starting point, dropped to earth gently and skidded to a stop. The pilot, tense with excitement, climbed down and shook himself.

"Well, I'm not dead yet," he thought. "I'll try it again."

Twice he repeated the experiment, with equal success. On a fourth attempt, just as he was coming to earth, a sudden gust of wind tripped the machine and turned it on end. It dropped like a shot. There was a crash of splintering wood.

"Looks as if there are a few things I've got to learn," remarked Foulois as he extricated himself, unhurt, and inspected the wreckage of the landing gear. "Next time I'll watch the wind."

So, somewhat ingloriously, ended the first day's flights of America's first air soldier in the first Army flying machine.

Two years before, at the Army Signal School at Fort Leavenworth, Kansas, Foulois had astonished Army men by writing, as his graduating thesis, the first military treatise on aviation. He had called it "The Tactical and Strategical Value of Aero-Dynamic Flying Machines." Despite its heavy name, this work was little more than a fantastic outburst of youthful imagination. It was a sort of Jules Verne vision of a war of the future, in which flying scouts soared above enemy lines, directing the fire of artillery.

THERE were those who scoffed at it; others, with larger foresight, were impressed. At any rate, the outcome was that Foulois was called to Washington and assigned by the War Department, with two other officers, to pursue the study of aviation. And when the Government purchased its first dirigible balloon in 1908, Foulois was the man chosen to operate it.

Thus it came about that in 1909, when Orville and Wilbur Wright were demonstrating the flying machine they had built and endeavoring to persuade Uncle Sam to buy it, Foulois was selected to observe the test flight which should determine whether the United States was to have an air service or not.

The course he marked out for this historic cross-country flight was from Fort Myer to Alexandria, Va. The Wright machine was to make the round trip, ten miles each way, and the requirements set by the Government for the test flight called for an average speed of at least 40 miles an hour.

IN A previous test Orville had crashed. Notwithstanding this, Foulois, with characteristic thoroughness, conscientiously made the course as difficult as possible, over hilly country, thickly wooded. For a machine that could fly at an altitude of only a few hundred feet at most, it was to be a real test. Wright himself was impressed by the hazards of the route, and remarked, "Of course you won't mind the danger, since you have yourself to thank for it!"

On the day of the flight, 15,000 people gathered on the field at Fort Myer. At intervals along the course, Foulois had strung small captive balloons to serve as markers. Since the added weight of a compass aboard the plane was considered a handicap, he relied on the balloons as guides. Wilbur Wright was on the ground to aid in the take-off.

The crowd cheered as the machine rose and sped toward the first obstacle, a wooded hillside. Approaching the tallest trees, Orville took no chances of soaring over them. He circled around them!

Nerves and muscles tense, the fliers spoke not a word. Foulois, with gaze fixed a thousand feet ahead, spotted the landmarks of the course; and as he did so, he signaled to Orville whether to bear to the right or the left.

"I looked downward only once," Colonel Foulois recalled, relating to me his experiences on that historic flight, "and then it was to see a little white haired old woman frantically waving a white tablecloth. I never will forget it."

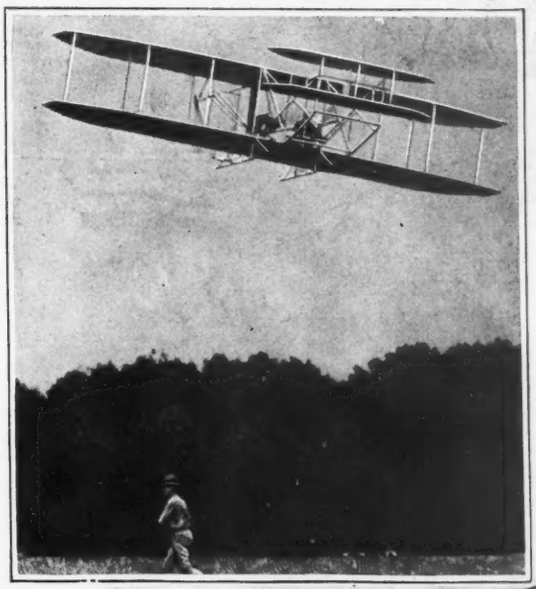
At Alexandria the fliers doubled back, making the return trip with increased speed. As the machine settled down safely in sight of the crowd at Fort Myer, the first to make toward them was Wilbur Wright. Studiously silent and undemonstrative, like his brother, he wasted no time in congratulations or handshakes. His words of greeting were an anxious question:

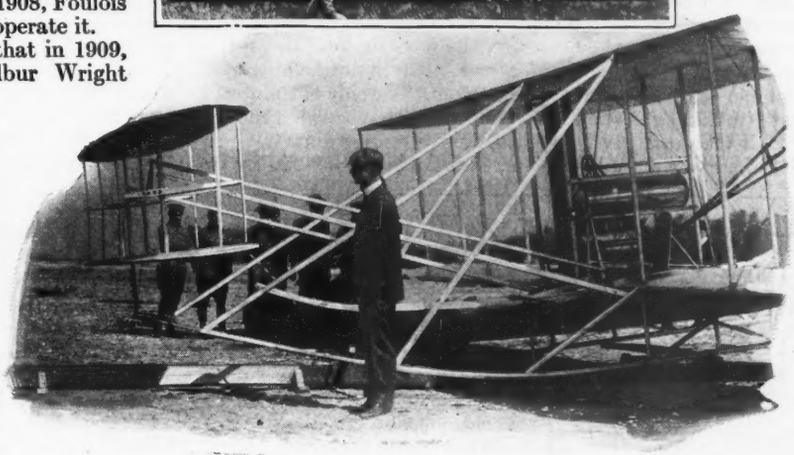
"What time did you make?"

Foulois had kept the record of speed and performance.

"Forty miles an hour out, and forty-five miles back," he replied. "That makes an average of forty-two and one half miles an hour!"

They had triumphed. For the Wright brothers, silently jubilant, it meant that their flying machine had surpassed the requirements of the test and would be purchased by the Government. For Foulois it meant the first step toward the realization of his dream of an Army air service.





Two Epic Flights in the History of Aviation

The top photograph shows the Wright plane in its test flight at Fort Myer in 1909 —a demonstration which broke several world records, though the plane circled around high trees instead of venturing over them! Below: Wilbur Wright before starting on the first flight ever made by a plane over water. It was made from Governor's Island; the plane had a canoe under it for safeguard in case of accident

MOREOVER, the flight had shattered three world records —for distance, for speed, and for altitude (they had reached the height of 600 feet!). Today, birdmen circle the globe, travel five miles a minute, and climb to a "ceiling" of nearly seven miles. Yet on that day at Fort Myer the records which seem ridiculous now were marvelous achievements.

As the spectators closed in on the birdmen, there occurred an incident, insignificant in itself, which left an indelible impression on the mind of the young Army officer; for it revealed to him for the first time one obstacle that stood in the way of his dreams for Army aviation. It showed him that to conquer the air was not enough; he must overcome also the deadly apathy of people. Colonel Foulois related the incident to me.

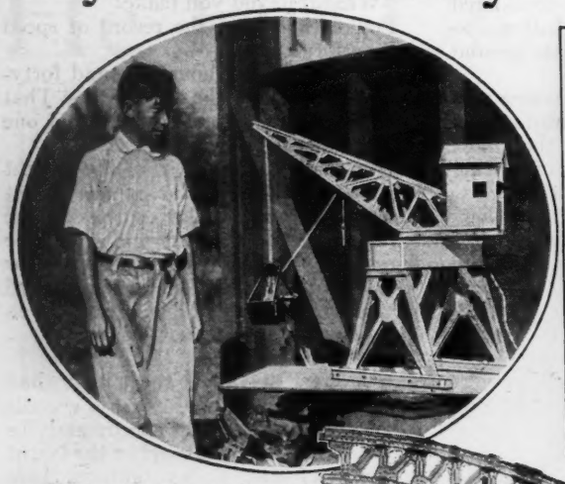
"As we pushed through the crowds," he recalled, "we came upon two straight-laced women in black bombazine dresses.

"'Well! Is *that* all there is to it?' one of them shrugged. 'I'm not going to wait any longer.' The other assented. 'It didn't amount to much!'"

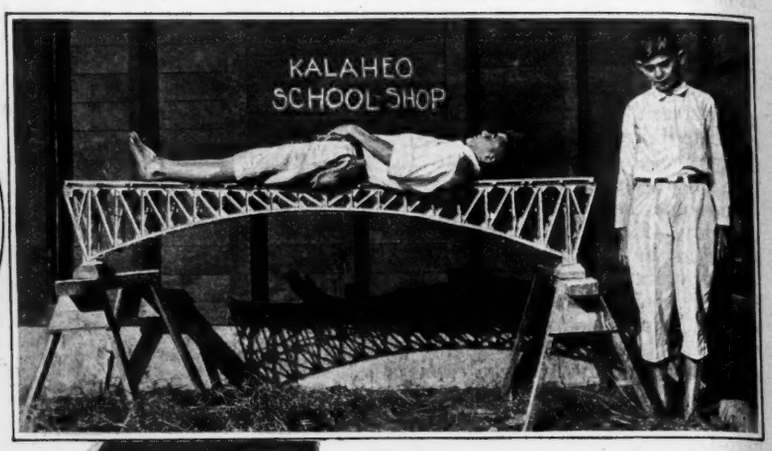
THIS same apathy, in official form, followed Foulois a few months later to San Antonio where, as a one-man Air Service, he struggled to fly the Wright machine. Having bought and paid for the machine, the Government apparently thought it had done enough. It allotted for the yearly upkeep of its first air venture the magnificent sum of $150! Foulois dug $300 out of his personal salary and spent it for repairs that first year.

During that year the machine crashed with him something like forty times! At the beginning his average of success was one crash to every four flights. Every time he crashed he would repair the broken parts himself. Then he would go at it again. With the result that toward the end of his self-instruction he sometimes flew daily for a whole week before he bit the dust! (*Continued on page 142*)

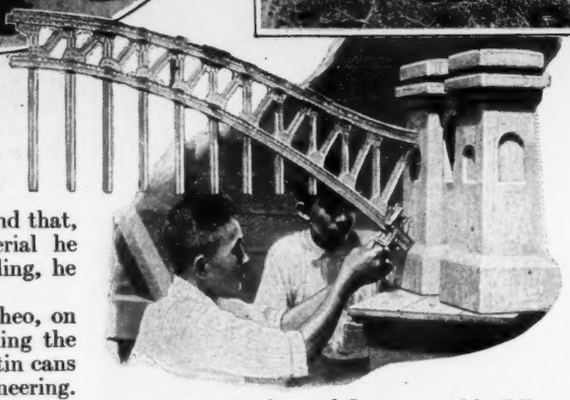
Boys Build Sturdy Models *Out of* Old Tin Cans



Old tin pineapple cans, flattened out, made the efficient little gantry crane and clamshell bucket above. With the same material these ingenious Hawaiian boys built the model of Hell Gate bridge which is shown at right



These future engineers found that even a tin bridge, if scientifically built, won't cave-in in the center. Here they are testing its strength



CRUSOE on his island found that, if he lacked any material he thought he needed for building, he could use something else.

High school boys in Kalaheo, on their island in Hawaii, making the same discovery, are putting tin cans to work in studying engineering. Freight charges made lumber too expensive to use for models, and near by was a pineapple cannery where they could have for nothing all the cans they wanted.

Out of these cans they have made unique models—trusses, columns, beams, girder bridges, arch bridges (including one of the bridge crossing Hell Gate at New York), a working model of a gantry crane, trestles and flumes, steel buildings, windmills, steam shovels, and towers.

To convert the cans into shapes which they can use, the boys first cut along the seams of a can with tinners' snips and remove the bottom. The side of the can is then flattened out with a wooden mallet and cut into strips on an ordinary paper cutter. These are folded or bent to shape on a common roofing folder and, laid over a full size pattern, are cut the right length. They are fastened together with flashlight eyelets, using draftsmen's clamps to hold the parts together temporarily. The holes in the strips are made with a gooseneck eyelet punch and finished with tinned copper eyelets.

The engineering designs are obtained from manufacturers' catalogues, magazines and books.

The finished structures are surprisingly strong, as can be seen from the photograph above of a boy lying upon a model of an arch bridge. Almost any type of structure can be duplicated in miniature under this system. The eyelets give a neat finishing touch, being nearer to the scale of the rivets in large structures than bolts would be.

"An Abandoned Shack Gave Us the Home of Our Dreams"

EARLY one Fourth of July Mr. and Mrs. Thomas J. Leinen set off a huge firecracker in a suburban yard near New York City. Two years later to the day, in the same spot, they set off another to celebrate the completion of a homemade house in that yard. Every bit of carpentry, plastering, plumbing and painting had been done by their own hands on Saturdays, Sundays, vacations and evenings.

They made their own plans, putting in as many windows as they liked (thirty-eight altogether), fireplaces where they wanted them, doors the height that pleased them. A shell of an unfinished house abandoned by a contractor was the starting point. It consisted of a foundation, four sides, roof, but no floors.

After working in an office all day, Mr. Leinen, put on overalls (or golf togs!) and became a carpenter. Mrs. Leinen, too, did practically all of the painting.

Above is the way the Leinens' house looks today, but when they started work on it, it was a weather-beaten wreck without any floors

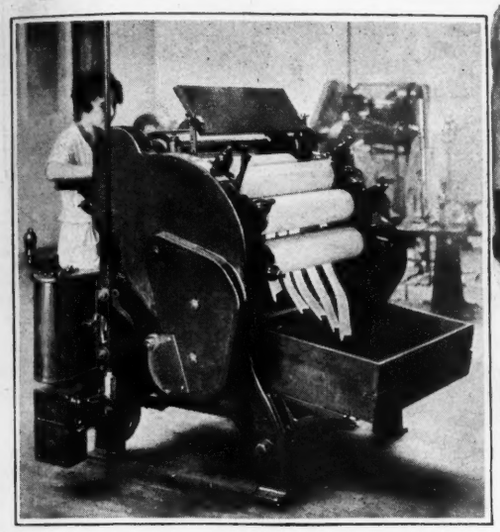
Every evening, after his day's work, and every week-end and every holiday, Mr. Leinen did a bit more on his house—until the last nail was driven

Mrs. Leinen did the painting, not only of the rooms but also of the outside of the house, in spare time

Photos Western Electric News

Eleven Power Machines Launder Your Collar

Shaping Fold Is Last Important Step—Amazing New Equipment



The ironer at the left, by its ingenious cylinder arrangement, gives a slick finish to the wrong side and a dull finish to the right side of a collar

Photos Laundryowners National Assn.

The collar ironing room in a modern laundry

COUNTING one man to a family and allowing him a clean collar a day, 22,698,744 collars are laundered every day in the United States. It takes 7400 power laundries—aside from home washing—to keep the American man's neck covering clean.

Responsibility for this important branch of laundering is laid on Hannah Montague, who lived in Troy, New York, a century ago. Before 1827 collars always were attached to shirts. Hannah noticed that collars on her husband's shirts got dirty much quicker than the shirts. If he could wear the shirts longer, she wouldn't have to do so much washing. An afternoon's sewing solved her problem; she made two collars for the same shirt. Out of that act, not only the whole collar manufacturing industry, but the collar laundering industry, too, have developed.

In the well-equipped modern laundry, your collars are squeezed through suds four times and rinsed five times. A "spinning basket" whirls the collars nearly dry, after which a starch wheel puts starch into them from both sides. On a moving clothesline they are taken on a trip through a dry room. Then they are dampened on porous rubber rolls which are kept moist, and left standing under pressure for half an hour for "mellowing."

Finally, they are ironed. A polished metal cylinder irons the wrong side of the collar, making it slick so that a tie will slip through easily. The right side is ironed by cloth-covered rolls to give a dull finish.

And even then your collar is not ready for you. The next machine moistens and polishes the tip edges so they will not wear out your shirt. Another runs a wet streak across the collar at the folds. The next one shapes and irons the top of the fold at the wet streak. A heated tube completes the drying as the collars push into a basket below.

Twenty-nine processes and eleven machines are thus used in the modern laundry to wash and iron your collar, and without damage, too.

Strange New Vehicles Amaze Pedestrians in Berlin

ROWING a "land skiff" on city streets is the latest diversion in Berlin, the city of strange vehicles. This ingenious machine, pictured below and called a "rudomobil," gives the rider all the motions of rowing. With his feet braced on flat pedals, he pulls alternately on the oars and whizzes through the streets. Pivots for the oars are set on braces at some distance from the seat on either side to give a good stroke. The handles are curved at the ends to afford a firm grasp for the hands.

The rider has the problem of keeping his balance which he wouldn't have in a boat, but which adds to the sport. The vehicle has two wheels like a bicycle, but these are set further apart than usual. To "row," the rider leans far forward and pulls far back. The foot rests teeter on pivots.

The second illustration shows another modification of a cycle—a monocycle. One wheel takes up just half the room of two, and the ingenious inventor saw in the monocycle a way to keep Berlin's streets less crowded. When the rider, on his way to work in the morning, gets into a jam, he picks up his cycle and tucks it under his arm until the traffic clears.

His feet braced on pedals, he "pulls the oars" as in rowing and whizzes along. Wide-apart oar pivots give a good stroke

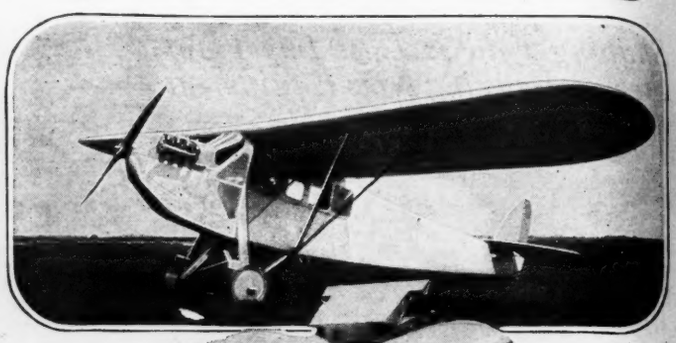
Riding to work on a monocycle is this Berlin clerk's way of beating traffic jams. Balancing oneself is quite a trick

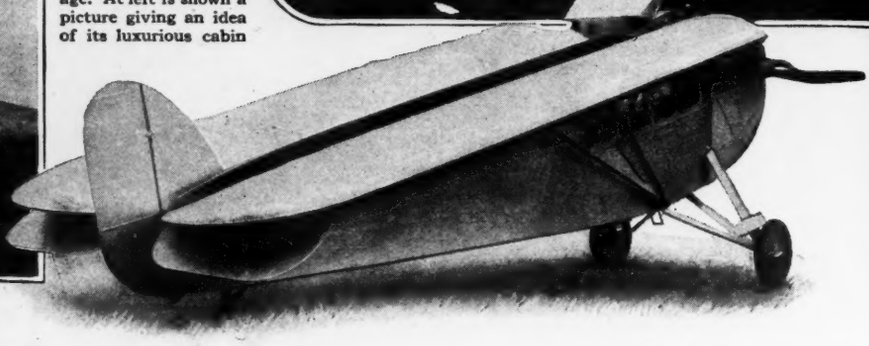
Airplane-Auto Folds Up to Fit in Garage

Long Island golfers entering the novel machine for a trip to the links

Its Wings Fold Like a Beetle's

This amazing machine, designed by Sherman M. Fairchild of aerial camera fame, is an automobile or an airplane as its driver desires. At the right it is shown with wings unfolded ready for flight. Below you see it ready for a spin on the highway, or to be stowed in its garage. At left is shown a picture giving an idea of its luxurious cabin





A SERIOUS competitor for space in the family garage has just been built at Farmingdale, N. Y. It is an airplane with wings that fold, enabling it to be driven along the highways like an automobile.

The machine is a cabin monoplane, designed by Sherman M. Fairchild, inventor of the aerial camera used by the United States Army and Navy and many foreign governments.

Golf enthusiasts on Long Island have already used this machine for visiting various clubs. Captain R. H. Depew, Jr., well-known aviator, who conducted the preliminary tests on the plane, keeps it in his garage, and on fine days drives it with its wings folded several miles to the aviation field. It requires only two minutes to unfold the wings, start the engine, and leave the ground. In the air, a speed of ninety-five miles is quickly attained.

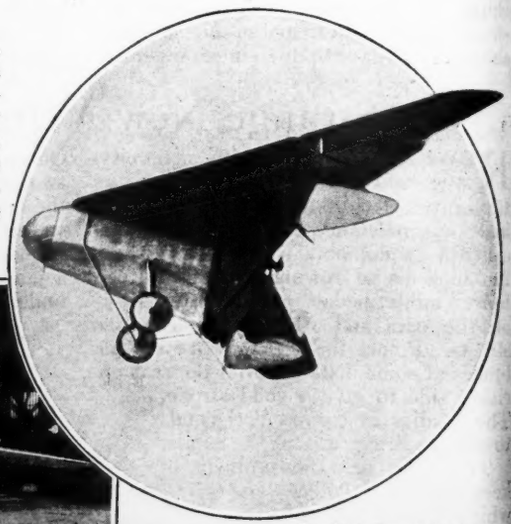
Another plane of the same type has been built for aerial photographic work. It has the first airplane dark room, so that pictures can be taken, plates developed and prints made while the ship is flying. The aerial camera, fitted into the floor of the cabin, has rubber around the edges to keep out the light. Auxiliary tanks in the wings hold the water for developing.

The passenger-carrying type accommodates two passengers and a pilot.

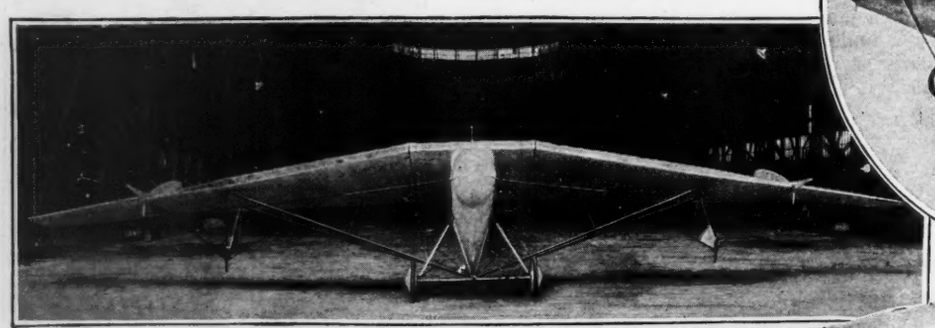
Tailless Air Flivver Feels Its Own Way

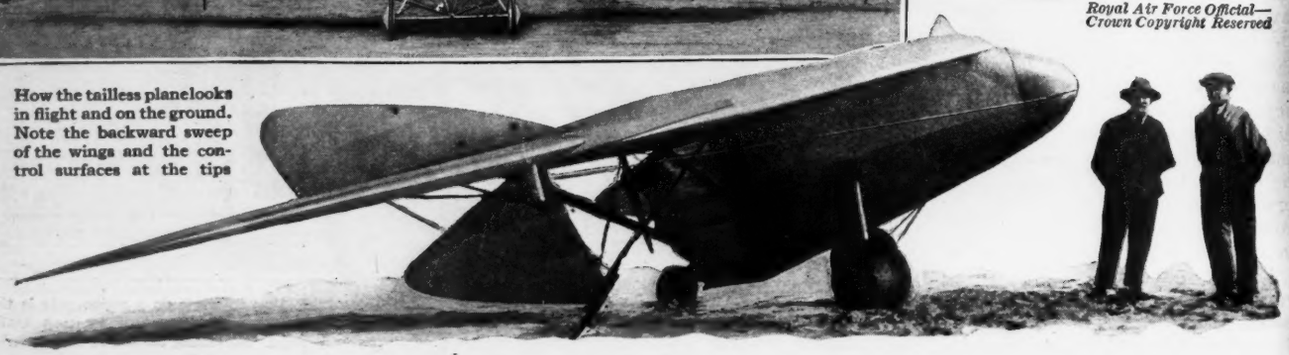
STRIKING innovations in design have been incorporated in a remarkable flivver airplane developed in England by Captain G. T. R. Hill, and tested recently. The most startling feature of the new plane is that it is tailless. Also, the wings, ordinarily straight, sweep back on each side of its abbreviated body in a V-shape.

This latter feature, coupled with control surfaces at the wing tips, which can be moved up or down like a finger, make the plane, according to its inventor, virtually foolproof. It will stabilize itself, it is said, even when the engine is stalled, under every conceivable condition of flying. In its tests the plane made seventy-five miles an hour.



Royal Air Force Official—Crown Copyright Reserved





How the tailless plane looks in flight and on the ground. Note the backward sweep of the wings and the control surfaces at the tips

Full Size Comb That Folds Up

THOUGH it will fold into a small carrying case, the comb above has the advantage of being full sized. It is hinged in three sections, and when unfolded is held out straight for combing by slipping a pin to one side. This pushes a small rod across the hinged parts, preventing them from folding back.

Concrete Today Is Strongest

BUILDINGS these days are just as durable as those of ancient times, if not more so, declares William M. Kinney of Chicago, general manager of the Portland Cement Association. He cites the results of recent comparative tests in the structural materials research laboratory of the Lewis Institute, Chicago, which showed that modern concrete is three times as strong as that laid by the Romans 1800 years ago.

Cubes of concrete in perfect preservation, taken from the foundations of the Forum in Rome, showed a compression strength of about 900 pounds to the square inch. Similar cubes from the foundations of a Chicago municipal improvement, although only twenty-eight days old, showed a strength of 3000 pounds.

Chemist Invents Machine for Cheaper Ozone

OZONE, a powerful oxidizing agent valuable in industry, produced in quantities and at low cost is a recent achievement of Michael DeKeyser, a chemist of Portland, Oregon. He has invented a machine that makes ozone by passing dry, clean, cold air between dielectrics and electrodes.

High tension alternating current establishes a brush discharge through the dielectrics, and this acts upon the oxygen contained in the atmosphere surrounding the field of discharge. The dielectrics are made of special glass, mica or bakelite, while the electrodes are of aluminum, which ozone does not oxidize. The glass dielectric used in the DeKeyser machine is able to resist 20,000 volts.

With cheap electricity, it makes ozone at $7.50 a ton

Taking a Light from the "Cabby"

PUNCH the jolly English cabby above in the nose, and his top hat will get red hot so that you may light your cigarette. This novel smoking accessory, which is of iron, may be attached to any electric light socket. The electric connection is made when the nose is pushed in, the heating element in the hat getting hot.

Skyscrapers Defy 88-Mile Gale

SKYSCRAPERS are built to sway in the wind, and most of them are planned to withstand a pressure of a wind blowing with a velocity of 88.6 miles or an indicated speed of 118 miles an hour. This means that they have been built even more substantially than was necessary, according to recent tests of the U. S. Bureau of Standards, for in most cities the wind rarely rises above 76 miles velocity or the equivalent of 100 miles an hour indicated speed. In New York, Chicago and St. Paul the wind sometimes reaches the higher figure.

The vibration in high buildings is no indication of weakness, but is the way the building adjusts itself to conditions.

Ten-Year Clock Runs on Own Electric Energy

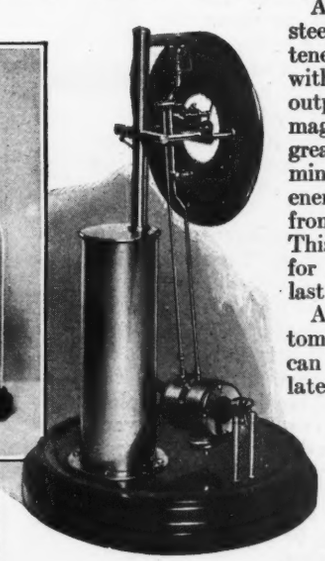
A CLOCK that runs without winding for ten years! That is the kind of timepiece most of us would like to own. Marcel Moulin, a French physicist, and Maurice Favre-Bulle, a well-known clockmaker, are the joint inventors of the clock for which this claim is made.

It is run by a special electric battery concealed in a tube at the back of the clock. The pendulum not only regulates the movement but is also geared to turn the clock hands. Electric current from the battery produces a driving force that exactly compensates the retarding forces acting on the pendulum, so that the pendulum, it is said, acts just as if it were free.

At the end of the steel pendulum is fastened an armature with a magnet. The output of this electromagnetic motor is so great that only a minute quantity of energy is required from the battery. This makes it possible for the battery to last so long.

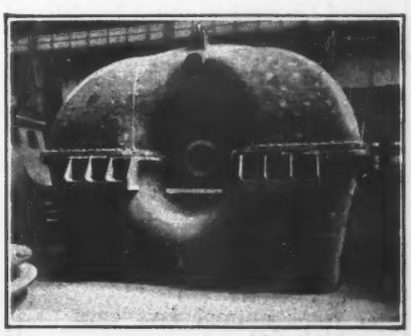
A screw at the bottom of the pendulum can be used to regulate the clock.

Start it running and you can forget it for ten years, except for adding water occasionally to the battery, is the assertion of the inventors of this remarkable clock



A special electric battery concealed in a tube at the back of the clock runs it, and an ingenious pendulum-electromagnetic arrangement creates its own electric energy

Iron Casting for Huge Turbine

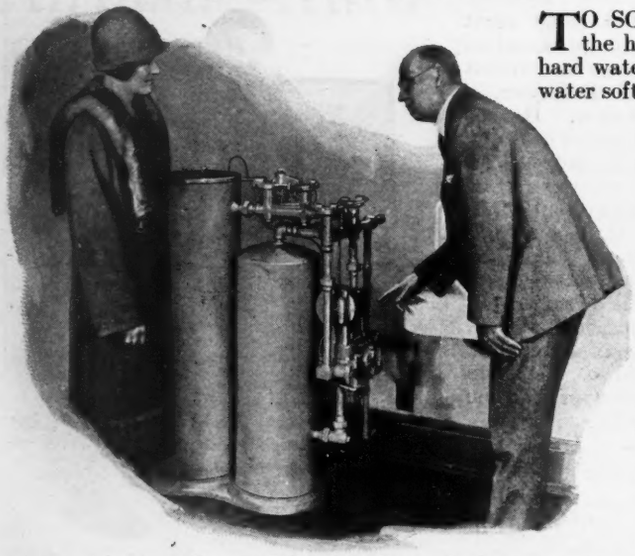


THIS huge mass of iron, weighing more than fifty-seven tons, was cast to encase part of a 50,000-kilowatt steam turbine being built in the Schenectady, N. Y., plant of the General Electric Company. It is the exhaust end, and measures about twenty-five feet wide, and nineteen feet high. The small ring in the top of the casting is there so that the huge mass can be lifted by a crane.

Jazz Gets a Timekeeper

IN A Paris dance hall where a new mechanical timekeeper has been introduced, the musicians must keep their eyes on a big dial, like a clock face, which beats the time and indicates how many beats are allowed in a minute. Its speed is controlled by the orchestra leader.

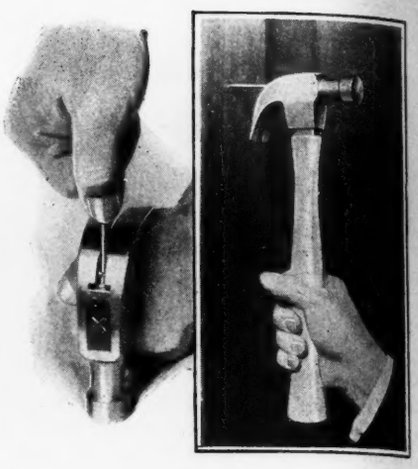
Household Water Softener Runs Itself



An earth mixture in one of the tanks changes hard water to soft

TO SOFTEN water right in the home, in cities having a hard water supply, an automatic water softener embodying several new features has been developed. It is installed in the basement and connects with the city water pipes.

One tank contains an earth known as natural greensand zeolite, which softens the water as it flows through. A second tank contains a brine solution which is forced through the first tank, when necessary, to restore the softening properties of the earth. No attention is required, says the maker, except to keep the brine tank full of salt.



Drives Nails in Bad Places

IF YOU are the handyman of the family, you'll welcome the nail-holding hammer above. It is especially designed for driving nails into awkward places. The nail is slipped in a groove in the top of the hammer and held tight in place by two projections operated by springs. One blow of the hammer starts the nail, after which the hammer can be pulled away.

Seesawing Alone Is Fun, Too!

NO PLAYMATE is needed at the other end of the teeter-board illustrated at the right. This new toy is a boon for the child who must play alone. A strong spring pulls him up and his own weight makes him go down. All he does is hang on to the rabbit's ears—but his leg and arm muscles get good exercise. The toy is made for children up to eight years.

All the thrills of the big boys' seesaw—and he can do it indoors, during bad weather, too

Fresh Bread in Two Hours

OUR grandmothers used to let their bread rise overnight. Modern bakeries, however, have speeded up the process, and now the invention of a new mixing machine makes it possible to bake bread forty minutes after mixing the flour with water.

The department of milling industry of the Kansas State Agricultural College invented the machine. It is said to break down the gluten in the dough, in fact to do the same thing ordinarily done by fermentation. The mixing takes only seven minutes, so, counting the time for baking, it may now be possible to make bread in less than two hours.

The texture of the finished bread is said to be as good as that in which the dough has been allowed to rise for several hours.

How Much Do YOU Know About Science?

IF YOU have a small son whose questions about this mysterious world seem endless, don't squelch him. That inquisitiveness will be one of his greatest assets later on. You might in fact profit by following his example yourself. How many of the questions below, for example, can you answer? You should, if you've always had a healthy curiosity, answer nearly all of them. Correct replies are on page 141.

1. Why is the sky often red at sunset?
2. Can there be a mirage on a city street?
3. What animal lays eggs as birds do?
4. How are the tides predicted?
5. Why can you swim easier in salt water than in fresh water?
6. Are there sounds we are not able to hear?
7. How does a dynamo produce electricity?
8. What are the oldest known works of art?
9. Why is iodine an important element of food?
10. How does a prospector know where to look for gold?
11. Why will a diamond cut glass?
12. Would it be possible to store up sunlight during the daytime and use it at night for illumination?

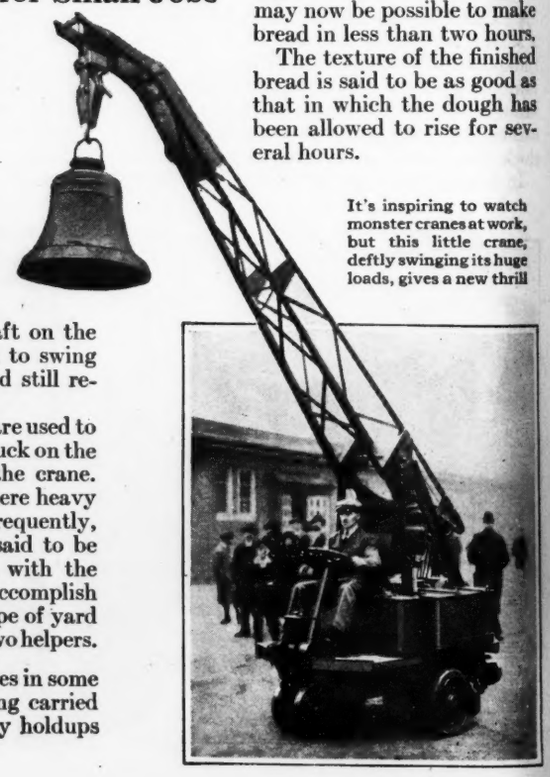
Motor Crane Built for Small Jobs

BUILT along the lines of a giraffe but with the power of a young elephant, the small motor-driven crane at the right was a center of interest at a fair at Leipzig, Germany.

Electric motors operated by storage batteries supply all the driving power to move the crane about and to lift all weights. The chassis of the truck is exceptionally heavy, and this weight plus the heavy storage batteries stowed far aft on the platform enables the crane arm to swing into the air with huge loads and still remain on all four wheels.

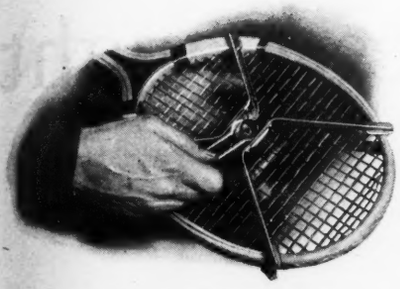
Foot pedals and hand levers are used to control the movements of the truck on the ground and to swing and lift the crane.

In many industrial plants where heavy objects must be moved about frequently, a motor crane of this type is said to be extremely useful, as one man with the motor crane should be able to accomplish more work than an ordinary type of yard truck in charge of a driver and two helpers.



It's inspiring to watch monster cranes at work, but this little crane, deftly swinging its huge loads, gives a new thrill

THE HUGE pay rolls for employees in some Mexican oil fields are now being carried by airplane, owing to the many holdups of automobile carriers.



Metal Tennis Racket Press Cannot Warp

MADE entirely of metal, this new press for tennis rackets can be adjusted to any thickness of frame, and is tightened from the center. The racket, while in the press, may be slipped in any ordinary racket cover, the maker says.

Why You Need So Much Gas

IF AUTOMOBILES could use the full energy capacity of gasoline, a small car could go 450 miles on a gallon, says Charles F. Kettering, president of the General Motors Research Corporation. As it is, the engine wastes ninety-seven percent of this precious energy.

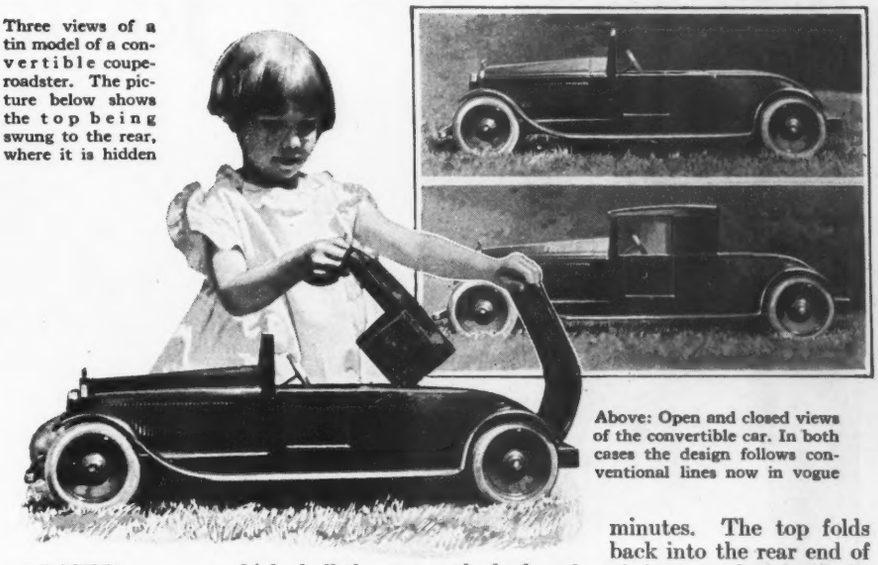
Mr. Kettering thinks that learning how to use more of the energy stored in gasoline is the greatest problem before automobile manufacturers today. Within six years, he predicts, the efficiency of the automobile motor will be doubled, with a view to lessening gasoline waste.

Now—Penny-in-the-Slot Milk

AT EIGHT in the evening the law forces most shops in England to close. There is no ordinance forbidding the sale of milk after that time, however, so several shopkeepers recently put milk vending machines, as shown at the right, in the fronts of their stores.

A penny in the slot (two American cents) releases half a pint of milk. Dealers find that this new machine enables them to get rid of their stocks every day, while the housekeeper who runs out of milk after closing time is equally appreciative.

Novel Automobile Body Folds Up

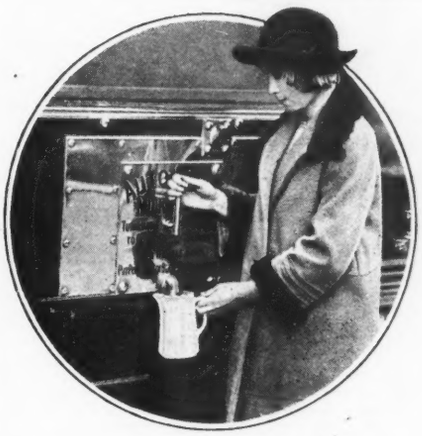


Three views of a tin model of a convertible coupe-roadster. The picture below shows the top being swung to the rear, where it is hidden

Above: Open and closed views of the convertible car. In both cases the design follows conventional lines now in vogue

CLOSED or open—which shall the new car be? For most of us with one-car incomes, it's a vexing question. But now John K. Mohr, of Bay City, Mich., has designed a car which should satisfy both sides. From a coupe with rigid top it can be converted into an open roadster in two minutes. The top folds back into the rear end of the body, where it is covered with a body plate, and one person can swing it back into position. A tensioning device helps in raising or lowering it.

Closed or open, the car is strictly conventional in design, nothing strikingly suggesting its convertibility.



A coin in the slot and a turn of the faucet release the exact quantity of milk desired

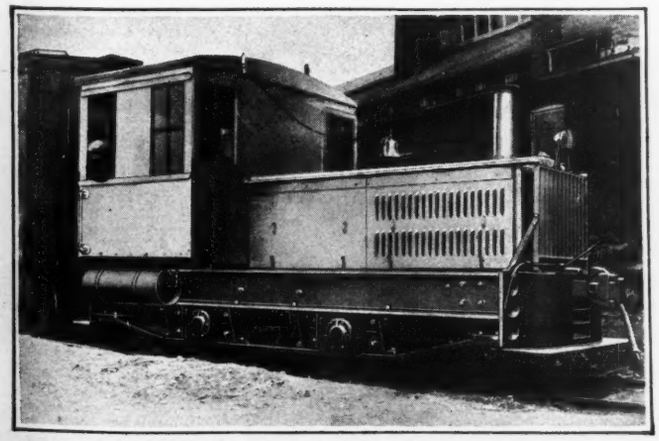
Young Aviators, Attention!

ONE thousand dollars for the first boy or girl under eighteen years who pilots a plane from San Francisco to Boston is offered by the American Society for the Promotion of Aviation, New York City. Participants must have licenses.

Gasoline Giant Pulls 1,770,000 Pounds

DESIGNED for switching railroad cars and handling heavy industrial and construction cars, the eighteen-ton gasoline locomotive below on a level track has the tremendous pulling capacity of 1,770,000 pounds. All four wheels are drivers. The locomotive has four speeds forward and reverse, giving a range of from two and two thirds miles to twenty-four miles an hour. It is driven by a 107-horsepower engine, and is operated much like an automobile.

Sand is carried to the tracks for the wheels as in the standard railway locomotive. It carries fifty gallons of fuel, fed to the engine by gravity.



This powerful gasoline locomotive, designed to replace steam engines for switching and yard work, is no harder to drive than your own motor car

Know Your Car

YOUR car cannot run efficiently without good ignition. An uncertain spark means weak explosions, loss of power, and wasted gasoline, as well as jerking and bucking at slow speeds. Excessive strain and wear is imposed on all the moving parts when the motor skips and runs unevenly.

Assuming that the wiring is not defective, your ignition troubles can always be traced to burned or pitted breaker contacts, a defective spark plug or a run-down storage battery. The latter trouble is usually coupled with generator trouble, as a battery in poor condition will give enough current for the ignition as long as the generator is maintaining its output.

Defective wiring may consist of a poor connection that impedes the flow of the current, a partial short circuit that causes an intermittent miss, or a broken wire that causes about the same result. To keep your ignition system up to full efficiency, watch the following points:

1. **Make sure the breaker contacts are clean and properly spaced.**
2. **Inspect the wiring frequently for loose connections or breaks.**
3. **Clean spark plugs occasionally.**

Oddities Caught

He Cooks Steak by the Heat of His Fog-Piercing Projector

So powerful is the fog-piercing machine above that a steak can be broiled in three minutes with its reflector, by the aid of the sun's rays, as Samuel W. Haines, its inventor, is demonstrating. It will burn clear through a plank of wood, and pierce the thickest fog like a needle. Beams that will reach 310 miles, will be his next achievement, Haines hopes

The Riddle of the Egg

Perhaps she was debating whether to go on a laying strike and then thought better of it. Anyhow, the freak question-mark egg shown above was found by the hen's owner when she gathered the eggs. It happened recently in Athenia, New Jersey. "Whitey never laid anything like this before," the owner anxiously explains, "and we all hope she never does again"

It Takes Three to Fly This Kite

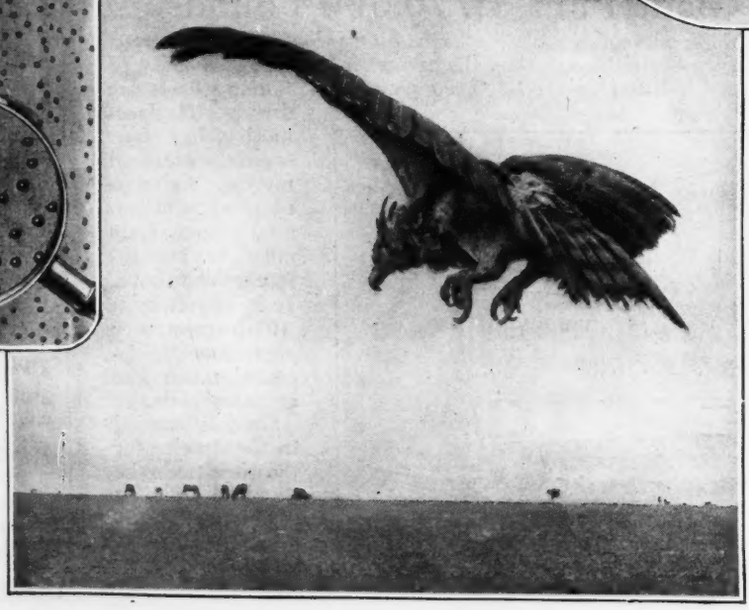
It takes a crew of three to sail this kite, which won first prize recently at a Great Lakes kite flying contest. Louis Dryer, of Toledo, Ohio, built the giant, which stands 14 feet 2 inches high. Launching it is no easy job, and it takes the combined strength of the three boys to manage it

Pocket-Size Talking Machine Fits in Hand Bag

Small enough to fit in your coat pocket and so provide entertainment on hikes or when you are out fishing, is the Lilliputian talking machine which the woman above is slipping into her hand bag. Tiny as it is, you put a record on it just as with the man-size article

Jewel-Like Dress Trimming of Flexible Glass

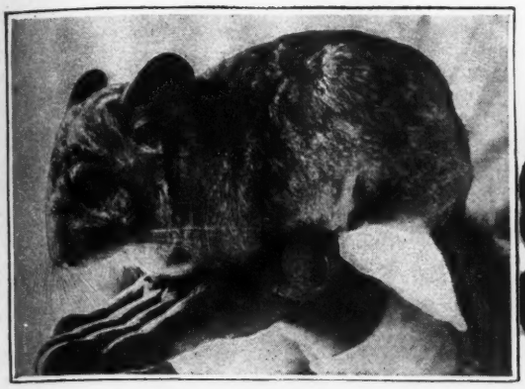
Instead of actually sewing beads on dresses, there is now a way of getting the same effect by "printing" little drops of glass on the fabric, this being an adaptation of the invention of flexible glass. The glass drops "bind in" with the material, which can be washed and ironed, it is said, without ruining its brilliance



The Eagle's Rocketlike Swoop

A photograph of an eagle swooping, like that at the left, is extremely rare, and the photographer who took it bagged a fine bird. The field is a Mexican sheepfold, and the eagle is swooping for prey within his weight requirements

by the Camera



An Expensive Handful

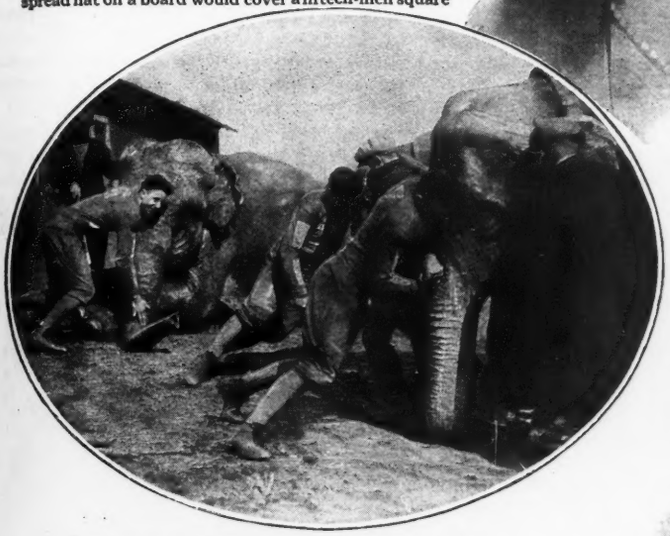
It looks like a queer rabbit, or an overgrown mouse. As a matter of fact, the scared mite above is an aristocrat among animals, a full-grown male chinchilla. The fine gray fur is an inch and a half thick, and if spread flat on a board would cover a fifteen-inch square

Eskimo Shields Protect Movie Actors' Eyes

Making movies in Alaska gave Hollywood stars a new idea to protect their eyes from the blinding Kleig lights of the studios. They're now wearing the slitted shields shown above, which Eskimoes wear for protection from the glaring snow

Airplane Flights in a Cabinet

A trip in an airplane to a height of 12,000 feet, with a rapid descent, once affected the eardrums of Julius Petersen, of San Francisco, so that his poor hearing seemed temporarily restored. To get the same "treatment" without the expense of buying an airplane, he has built the ingenious air pressure cabinet above. Now, simply by pressing a button, he ascends to high altitudes and swoops again to heavy pressure atmosphere

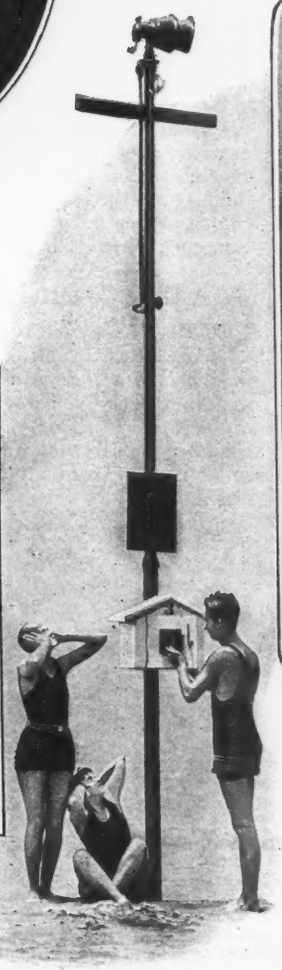


Football Team Wrestles with Elephants

Football players who could buck this line of elephants would sweep over any gridiron in the country, so probably, since we didn't hear to the contrary, the outcome of this bout was a victory for the pachyderms. However, the elephants gave this Drake University team good practice

A Juniper Tree 6,000 Years Old

Near Logan, Utah, students of the Utah Agricultural College discovered the gnarled juniper tree above, twenty-eight feet in circumference. Investigations by Dr. Henry C. Cowles indicate that the tree is nearly 6,000 years old, ranking it with the California redwoods among the world's oldest living things



Roll Yourself Thin!

If rubbing off fat can do it, the new exercising machine above should make anyone sylphlike. A slowly revolving cylinder covered with closely spaced rollers, irregular in shape, kneads and massages the body as you press against it. It is motor-driven

Beach Siren Summons Life Guard

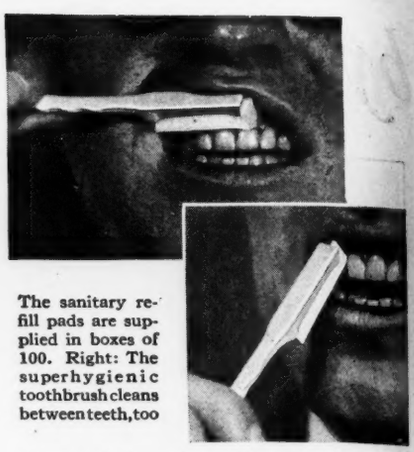
Operated like a fire alarm, a siren recently installed at Santa Monica Beach, Calif., (left) sends forth a piercing wail to call life guards to the rescue of bathers in distress

Now They Plane Wood Electrically

Motor-driven, this plane is said to produce perfect regularity and accuracy

JUST as the handsaw and other shop tools have been adapted for motor operation, so now inventive genius has electrified the wood plane, too. England has just introduced such a motor-driven hand plane, in which the ordinary fixed steel plane is replaced by a rotary steel cutter. This cutter is driven, through the medium of suitable pinions, by a motor built to operate on either direct or alternating current.

The cutter, nearly five inches wide, is designed to rough plane even the hardest woods. On beech or oak, it easily produces a cut one eighth inch deep with a rapid forward movement. To ensure straight guidance, the rear part of the machine, which rests on the already planed wood, is kept always on an exact level with the rotary cutter, while the elevation of the forward part can be adjusted to limit the depth of cut.



The sanitary refill pads are supplied in boxes of 100. Right: The superhygienic toothbrush cleans between teeth, too

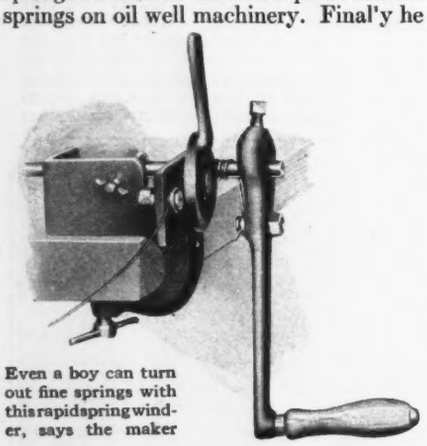
A Toothbrush without Bristles

YOU can be sure of a sterile toothbrush every time you brush your teeth, with the unique brush illustrated above. It is really not a brush, but a handle with a narrow groove in which pads of absorbent cotton fit. Tooth powder or paste is used on the pad just as on a brush. The pad is destroyed after use, and new ones are slipped in place easily.

At one end of the handle is a small projection shaped so as to clean between the teeth.

Make Your Own Coil Springs

WORKING in the oil fields of northern Ohio, a mechanic was continually confronted with the need for coil springs in various sizes to replace broken springs on oil well machinery. Final'y he worked out a machine that would make both compression and expansion types of springs, any size, any length, and this machine, shown above, is now being sold.



Even a boy can turn out fine springs with this rapid spring winder, says the maker

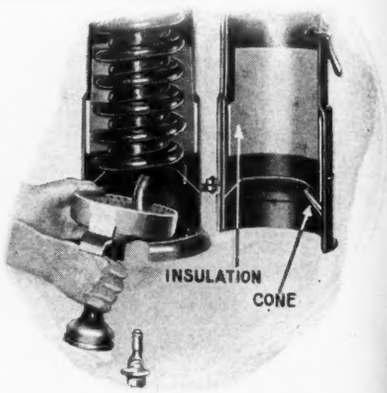
The size of the spring is determined by the size of mandrel used, while its pitch is determined by the position of the cam. The spring is made by turning the crank.

ESTABLISHING a new record, a motorless glider, piloted by Ferdinand Schulz, of Germany, and carrying a passenger, recently stayed up 9 hours 21 minutes.

Lift-Out Gas Burner Stops Clogging of Heaters

TO KEEP the gas burner in your tank water heater in good working order, it must be cleaned frequently. Ordinarily, this is hard to do. A new gas heater, however, has been designed, in which both the burner and mixer may be removed instantly for cleaning, without the use of a wrench or breaking the gas connection.

As shown in the illustration, moreover, a deflecting cone built into the heater catches particles of soot and scale that block up the burner, and so prevents them from falling onto the burner parts. The flame, too, is prevented from touching the bottom coils where it might deposit carbon.



Besides catching soot, the cone deflects and concentrates heat on the coil

A City Covered with Steel

SPARKS from chimneys in New Braunfels, Texas, have little chance of doing harm, for it is a city covered with metal. Ninety-five percent of its roofs are of sheet steel. Thirty years ago a fire chief began outlawing wood roofs within a small zone. Gradually the whole city was included.

Storage Battery Runs Crane

USING storage battery locomotives to operate crane hoists was a recent successful experiment in the Kearny, N. J., plant of the Western Electric Company. The crane moves cable reels in the yards and draws ash cars back and forth. It weighs 105 tons, which is quite a load for a storage battery to move.

A Sight-Seeing Bus with End Seats for All

SIGHT-SEEING busses where everyone has the coveted "end seat" and can survey at least half of what's to be seen to his heart's content, are now with us. They were introduced at the Philadelphia Sesquicentennial this summer.

Two long benches running the length of the car are set back to back, with an aisle for the conductor between. The car is covered with a canopy and accommodates forty.

Sight-seers whose whole trip is ruined unless they succeed in capturing the end seats will welcome this new bus, introduced in Philadelphia. Two long rows of seats placed back to back solve the problem

Movies in a Phonograph Cabinet

ALL you need for the home movie show is contained in the cabinet above, according to its inventor, Arthur G. Merriman, of Memphis, Tennessee. No darkening of the room is necessary. The picture is projected from within the cabinet on a panel of ground glass.

Back of this is a lamp house in which a beam of light falls on a slot over which film passes when a crank is turned. A mirror arrangement reflects the pictures so that they fall enlarged on the screen. The device uses standard movie reels.

Saving the Camp Fire Cook's Hands

IN PLACE of a pointed stick cut from a nearby tree—the usual makeshift for broiling steak on a camping trip—an inventor offers a broiler especially designed for camp fire cooking. Its long handle, measuring twenty-four inches, keeps the cook's hands a safe distance from the coals, as shown.

The mesh, ten inches square, is fine enough so that sausage may be cooked without falling through.

Broiling steaks with the new camp fire broiler. Its two-foot handle keeps the hands far from the hot coals

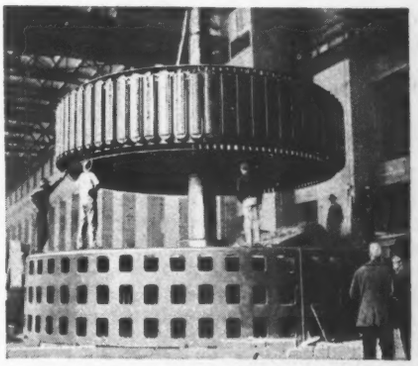
Our Fuel Wealth in Lignite

NORTH DAKOTA farmers who have been digging their winter's supply of coal from hillsides where veins of it stuck through, are awakening to the fact that the coal lying under their state amounts to one third of the total coal deposit in the United States. The great veins have been little exploited because the coal is lignite, a quality of coal between peat and bituminous. But new methods for using it have now been found. It can now be pulverized and made into briquettes; it contains large quantities of petroleum oils; and it has valuable by-products of ammonia and tar. There are 10,000 cubic feet of heating gas to every ton of the fuel.

THE FIRST completely electrified open pit mine in the United States is at Colstrip, near Forsyth, Mont. The equipment includes electric shovels and two 60-ton electric storage battery locomotives.

A Rotor for Muscle Shoals

SOME idea of the tremendous size of the mighty generators at Wilson Dam, Muscle Shoals, is given in the photograph below, which shows one being



put together. The rotor, upon which one of the men has placed his hand, weighs 293,000 pounds. It goes inside the circular stator upon which the men are standing, and is made to turn. When the rotor is properly "excited" with direct current, this rotation generates electricity in the windings of the stator.

COFFEE bags made of a common weed may displace burlap bags and save Brazil's exporters millions, if a young university student's idea is carried out.

New Vise Speeds Up Pipe Bending

The pipe is held so the vise cannot kink it

CONDUIT one half inch and three quarters of an inch may be cut, threaded and bent without removing it from the vise, using the new pipe bender vise illustrated at the left. As a vise it will take conduit up to two inches.

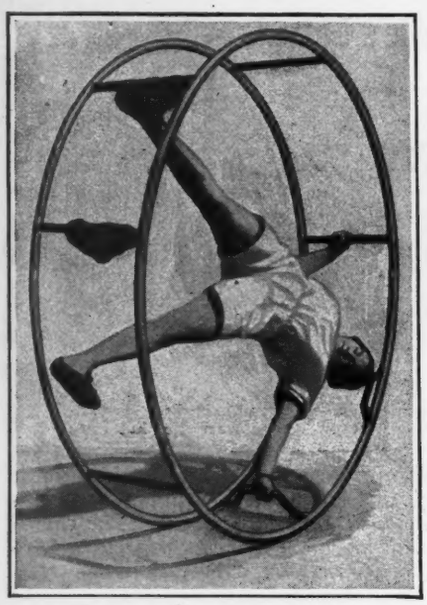
The bender will make offsets, saddles, goosenecks and other difficult bends, it is said, quickly and accurately. Bends may be made downward or sidewise. The forms and roller hold the pipe to shape so that the vise will not flatten or kink it. After the measurements are taken, the operation is entirely mechanical.

Railroad Gate Halts Autoists at School Crossing

SCHOOL children who daily use the street crossing near their school in Evanston, Ill., now have the extra protection of a "railroad gate." Juvenile traffic officers were formerly stationed at this crossing, but their signals were often not heeded by autoists. So Motorcycle Policeman Elmer Reiter installed the crossing gate shown at the right, which the junior police now simply lower whenever necessary to allow children to cross.

A GERMAN chemist, it is reported, has discovered a way to save movie films by eliminating scratches and other signs of wear from celluloid. The secret lies in adding a new ingredient to the film.

Motorcycle Policeman Reiter watching the operation of his "railroad gate" by the juvenile police officers who make this crossing safe for the children of an Evanston, Ill., school



Rolling One's Way to Health

HEAD over heels rolling is the newest form of exercising in Europe. The device used is a double hoop connected with rods, shown above. Two curved handles afford a good grasp for the hands, while special attachments hold the feet and head firmly in place.

It is used not only as an exerciser, but also by those training to become aviators.

Noiseless Auto Gears Here?

NEW gears for automobiles, which are said to permit noiseless operation and increased load carrying capacity, were described to the Society of Automotive Engineers recently. These "hypoid" gears, as they are called, can now be made with no higher cost, it was said, than spiral bevel gears. They are described as "tapered gears with offset axes."

A few drops of gasoline kill the plant

It Kills Weeds with Gasoline

KILLING weeds with gasoline is the purpose of the new garden tool shown at the left. It looks like a cane and is filled with gasoline. The sharp point of the cane is pressed into the ground at the root of the weed and lifted quickly. This releases a small quantity of the liquid, and within three days the weed dies. If correctly used, the gasoline will not spread to the grass, the maker says.

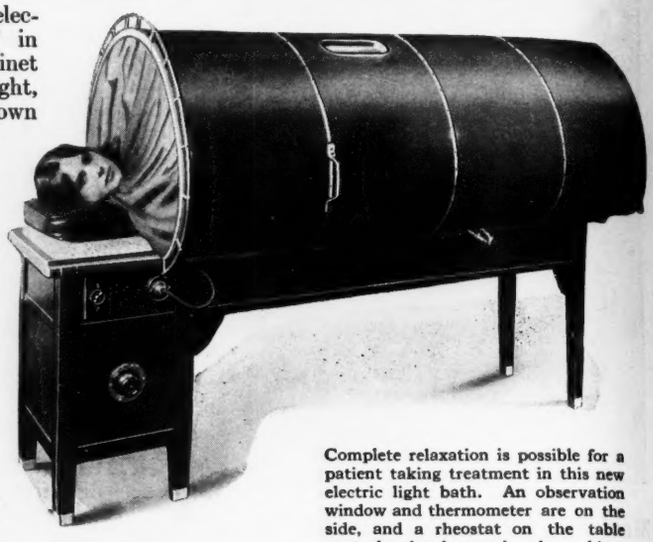
Cylindrical Homes Roomy

CYLINDRICAL houses are being erected in Germany to solve the housing problem. The houses are of standardized construction, all sections being interchangeable. Rooms are on two floors, and a cupola intended for storage purposes surmounts the house.

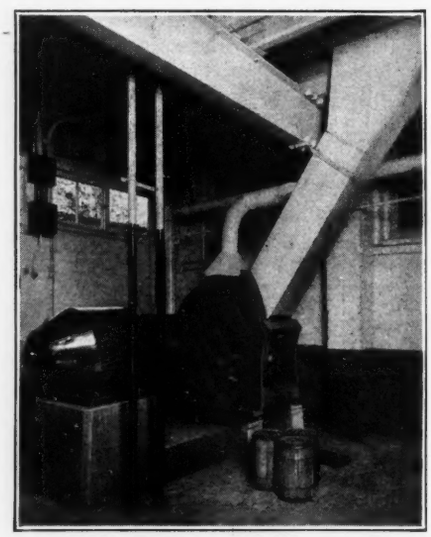
Cushioned Comfort in an Electric Light Bath

IN TAKING an "electric light bath" in the new type of cabinet illustrated at the right, the patient lies down comfortably while receiving the treatment. A semicylinder resting on a cushioned table and lined with highly polished German silver distributes evenly the light rays from twelve high-power tungsten lamps in the interior of the case.

The cabinet slides on rollers, and can be removed, leaving an electric treatment table.



Complete relaxation is possible for a patient taking treatment in this new electric light bath. An observation window and thermometer are on the side, and a rheostat on the table controls the lamps in the cabinet



All wood scrap is conveyed direct from the factory floor to this novel furnace

THE U. S. Bureau of Fisheries are trying to learn why mackerel are plentiful some years and scarce at others, so that their abundance and size can be predicted before the fishing season.

Sawdust Salvaged for Fuel

WOOD shavings and sawdust are no longer an expensive waste, but are actually used for fuel through a unique system established recently in the plant of the National Cash Register Company, Dayton, Ohio.

Through an exhaust system, all wood scrap is sent through a hogging machine that removes nails and chops the wood into bits. It is then sucked through a charger into a line that carries it to a storage bunker in the power house. From there it goes into a specially built furnace. The wood is consumed while it is in suspension and burns like gas. There are no ashes or smoke. Two pounds of the refuse, it is estimated, equal one pound of coal in heating value.

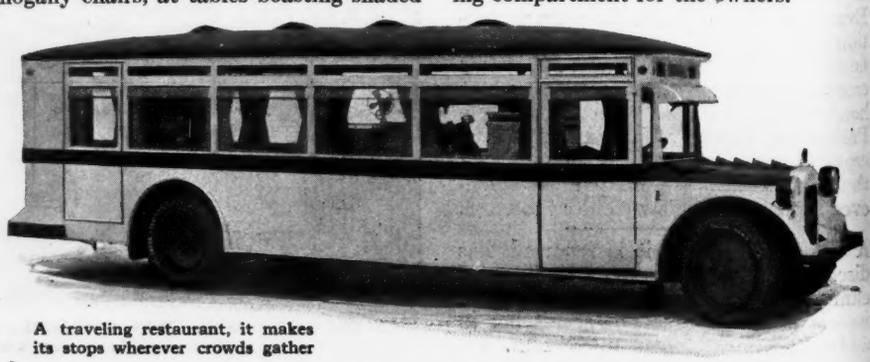
Diseases Your Plants Fight

IF YOU have a farm or garden, you may be discouraged by a list of plant diseases issued recently by the Department of Agriculture. Your rose bushes may be afflicted by any of thirty-nine diseases. Wheat is susceptible to thirty-one, corn to twenty-eight. Forty-two enemies lie in wait for tomato plants, and apple trees fight against sixty-six diseases.

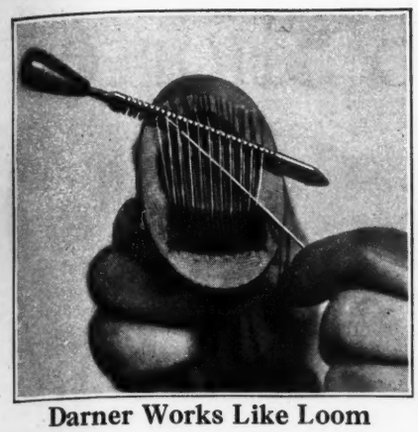
Motor Dining Car Serves Hungry Thousands

A MOTOR Pullman dining car which travels over the country, offering diners all the luxuries of eating on a train, is a new and aristocratic version of the popular lunch wagon.

While the patrons sit comfortably in mahogany chairs, at tables boasting shaded lamps and even little incense burners, they can listen to dance music over the radio. A kitchen in the same car has a gasoline range, meat and bread slicer, cash register, soda fountain, and its own refrigeration system. There is also a sleeping compartment for the owners.



A traveling restaurant, it makes its stops wherever crowds gather



Darner Works Like Loom

WORKING on the principle of a loom, the device pictured above offers a new way to perform the ancient task of darning stockings.

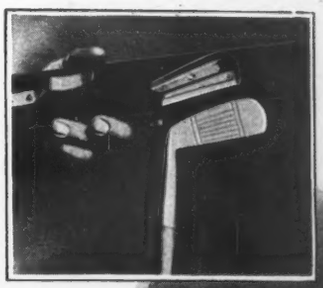
Stitches are made lengthwise across the hole. Then the device is inserted crosswise so that little teeth lift every alternate thread. The needle with darning cotton can now be slipped through and fastened. The mender is then turned on its other side, causing the other set of threads to be lifted, and the needle is sent back to the opposite side. This is repeated until the hole is covered.

TWO OLD sundials discovered in Ireland are said to prove that daylight saving existed hundreds of years before the twelfth century. The ancient Irish hour varied, the daylight hour in midsummer being 80 minutes, and in winter only 40.

Sand Scraper Smooths Golf Green

KEEPING sand greens smooth presents difficulties to golfers who, of necessity, must use sand instead of grass greens. Scrapers left near the greens get in the way and, moreover, have a habit of getting lost, strayed and stolen.

Judson R. Brady, an oil operator of Arkansas City, Kansas, deciding that to "carry your own" was the best plan, has invented the portable scraper illustrated. It is a wood blade that can be fastened by means of an adjustable clip to the head of a right-hand steel putter, and detached by a slight twist.



Easily attached to a steel golf club, this handy scraper levels the ground on sand greens

"Movies" from Picture Cards

TO EXPLAIN complicated mechanical operations, slow motion movies, of course, are the best means. A less expensive way, however, is by means of a small device producing moving pictures without using films or light, invented recently by a Frenchman. It is based on the same idea as the little books of pictures which children flip.

Pictures, each slightly differing, are placed on a band and fastened on a reel in a box resembling a camera. When a crank is turned, the pictures pass over a slot in succession so rapidly that they give the appearance of motion.

Start Highest Aerial Tramway

DESIGNS have been completed for the world's highest aerial tramway, to scale the 14,501-foot summit of Mount Whitney, California. The "Mount Whitney Skyway" will be its name.

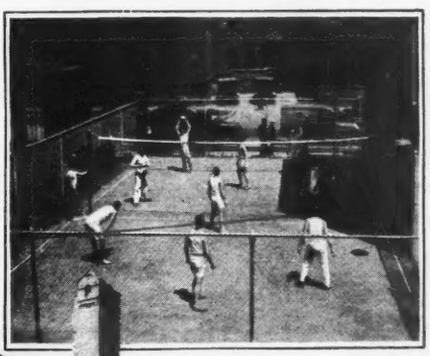
In cages suspended from inclined cables, passengers will ascend five miles to the pinnacle, all the while swaying from crag to crag and looking down into canyons and ravines. Halfway up there will be a stopping place and a hotel. On the crown of the mountain—a seventy-acre flat covered with stone slabs—will be erected another hotel, from which thirty of America's tallest mountains will be visible. The cost of this tramway is estimated at $350,000.

Odd Office Building Unites Old and New

WHILE large industrial organizations occasionally give their employees artistic surroundings and recreational advantages, it is unusual to find this true of small concerns. A private office building erected recently in Detroit, Michigan, for George Harrison Phelps, Inc., an advertising agency with slightly more than a hundred persons, is therefore a new departure.

A gymnasium in the basement with dressing, shower, locker and rubbing rooms, a barber shop, library and kitchenette are provided in the building, as well as reception rooms and offices. At the rear is an open air volley ball court.

In appearance the building is of the type of brick architecture of the Middle Ages found in northern Italy.



Behind the medieval-looking structure, very modern-looking white-flanneled youths volley on the open air court

From the street you see a stair tower, stone terraces, a picturesque balcony with marble column, and high Italian windows—perhaps the most unusual front for a modern office building in all Detroit

To Time Your Telephoning

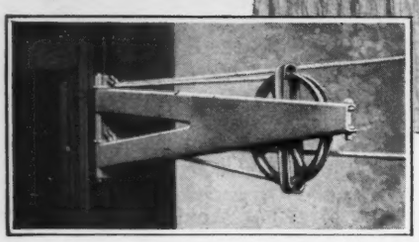
KNOWING when your time is up on long-distance telephone calls might save you much money in the course of a year. This timing device for attachment to telephones consists of a three-minute sand glass mounted on a piece of matboard. When the sand runs low, you know your time is almost gone.

Sand in the glass runs three minutes

New Gas to Drive Zeppelin

A NEWLY discovered gas will be used for fuel instead of gasoline in Germany's super-Zeppelin, now under construction at Friedrichshafen. Not only will this gas be a great step in making flying safer, but it will make possible longer flights and higher speed. Only a slight alteration in motors is said to be necessary in order to use the new fuel.

Ways to Shorten

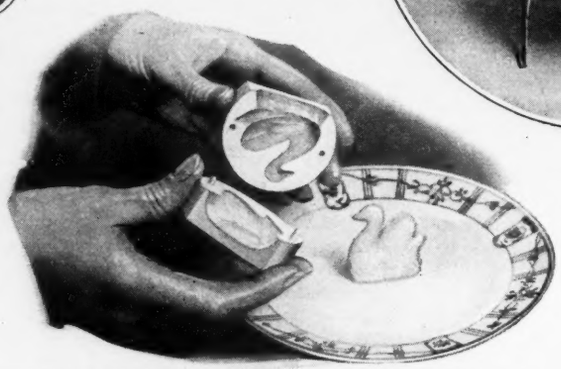


Safety First in Hanging Clothes

A new safety bracket to which the clothesline pulley can be fastened is shown above. Leaning out of the window to hang clothes is an awkward operation at best, and has caused many accidents, but this bracket swings inside the room as shown in the upper picture. When the clothes have been fastened, the bracket is swung outside again

Decorative Butter Molds

Butter molded in fancy shapes adds greatly to the attractiveness and interest of the dinner table. It isn't much trouble, either, when little molds of wood, hand carved in figures of birds and animals, are used. The one shown below makes a graceful swan. The butter in its mold is dropped into ice water to keep hard until ready for serving

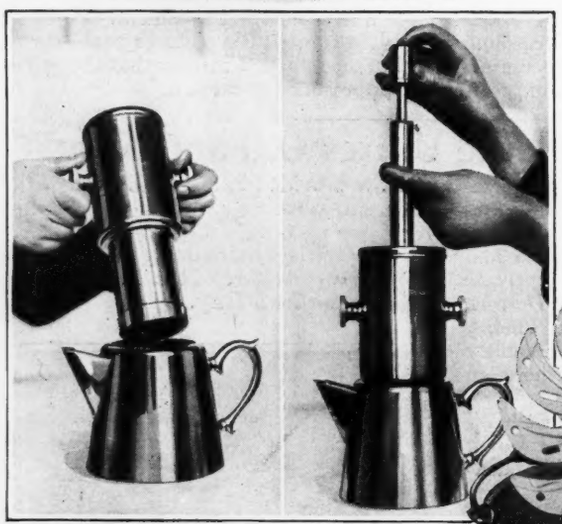


Butter Dish Holds Ice

Even in a warm room, the serving dish above prevents butter from softening while on the table. It is shaped like a sphere, and has cracked ice in the bottom, below a glass container. The upper part of the sphere is a lid covering the dish

Combination Ice Pick and Bottle Opener

When you take the pop out of the refrigerator, do you always have to hunt next for the corkscrew or bottle opener? If they are right on the spot in the handle of the ice pick as illustrated at the left, both time and patience are saved. Ice picks may now be had in this handy combination design



Collapsible Bottom for Cooking Pots

To prevent pot roasts from sticking to the bottom of the pot, the collapsible bottom, below, has been devised. Turning the cylinder in the center changes the diameter to fit pots of different sizes. It keeps the meat off the bottom of the kettle and lets the juices circulate freely

Speeding Up Filtered Coffee

Filtered coffee, as everyone agrees, tastes much the best, but the water trickles through so slowly that the method has never been widely adopted in America. Now, to make filtered coffee quickly, a French inventor has devised the compressed air coffeepot shown above. A small pump worked by hand compresses air that forces boiling water through the ground coffee and into the pot below

Drip-Coffee Pitcher for Table Service

For making drip coffee, the aluminum and glass combination shown at the right is new, attractive and serviceable. Boiling water is poured into the aluminum filter, which fits into a glass pitcher. When ready for serving, the filter is removed and the coffee served directly from the pitcher

Spoon and Chopper in One

The odd-looking combination spoon and chopper illustrated at the right is a kitchen helper imported from abroad. It means one less tool needed in preparing the vegetables for dinner, and one less tool to hunt for in the drawer. The vegetables or fruit are chopped with one side of the tool and scooped up with the other side

Household Tasks

The Corn Popper Modernized

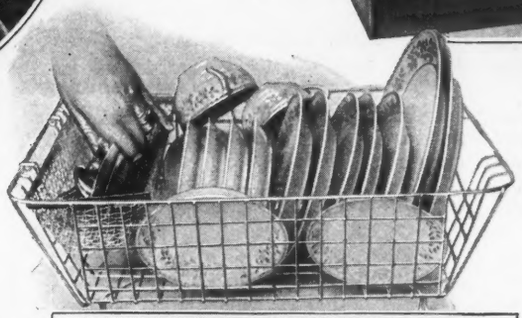
If you like to see the corn pop, you will enjoy using the new popper above, which has a glass cover. Instead of shaking the whole utensil, you simply turn a handle on the lid, which is attached to a wire stirrer

Wire Dish Drainer with Silver Basket

The new dish drainer shown below has a little basket for silverware which can be turned over the edge of the drainer and so out of the way when the silver has been wiped dry. In the ordinary drainer, where the silver is laid helter-skelter among the dishes, the pieces have to be fished out and often slide down through holes between the wires

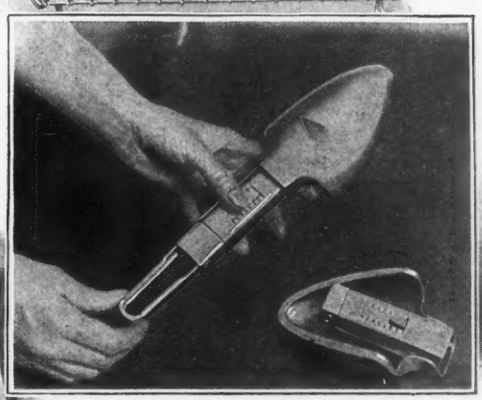
An Ice Box for the Picnic

Any woman who has had to plan lunches for picnics and all-day auto trips will appreciate an ice box like that above, designed to fit on the running board of a car. A waterproof box containing the ice is covered with a lid and can be slid from end to end of the chest



Can Opener Clamps to Table

One of the first requisites of a modern kitchen—now that canned foods are replacing home prepared foods to a great extent—is a good, substantial can opener. The one illustrated below may be kept permanently clamped to the edge of the table, ready for instant use It works by turning the crank



Shoe-Trees Easy to Adjust

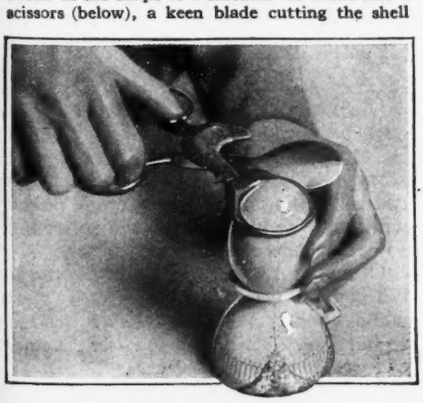
Shoes of different sizes can be fitted with the new shoe-trees illustrated above, by a simple adjustment. They are unusually substantially made, according to the maker, and modeled on the latest lasts. They can be folded up also

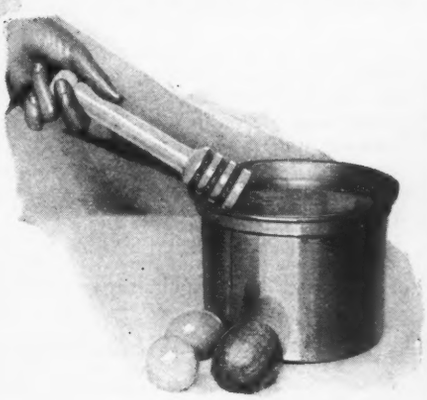
Tea Strainer Fits in the Pot

Tea strainers that dangle from the spout of the pot are an unsightly makeshift at best. A new idea in strainers is one that fits inside the teapot instead of being used on the outside. It is on a thin aluminum band, which fits the curve, placing the strainer over the base of the spout

Egg Cutter Shaped Like a Chick

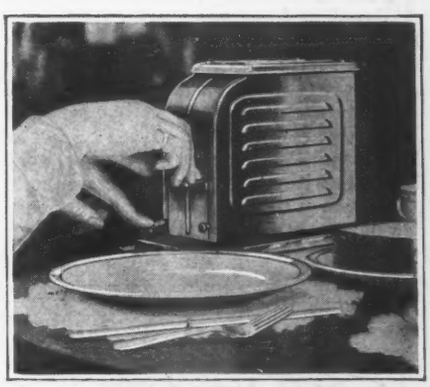
An amusing tool for the breakfast table is an egg cutter in the shape of a chicken. It works like a scissors (below), a keen blade cutting the shell





A Water Heater of Many Uses

Heat in the liquid itself instead of at the bottom of the kettle serves quite as well for cooking, when no gas burner is available. This electric immersion heater, above, can be used for cooking vegetables or eggs, for heating shaving water, etc. It is simply immersed in a kettle or tumbler of liquid and the current turned on



This Toaster Can't Burn Toast

You can't burn the toast in this new electric toaster, says the maker. You needn't even watch it while it's toasting. By means of levers, the toaster is adjusted to the degree of brownness you like best in your toast. When the toast is browned, the current is automatically shut off and the toast raised out of the way

Helps for Radio Beginners

What Rheostats Do for Your Tubes

Binding Post Connections and Troublesome Wires

MANY radio beginners wonder why it is necessary to use special rheostats to control the current through the vacuum tubes in their radio receivers. No such rheostats are needed on the electric light bulbs in your house, and the reason for the rheostat on the vacuum tube is not apparent until you begin to study the current supply available for radio use.

The power company takes great pains to maintain the voltage of your house supply within very close limits, so that no matter what time of day or night you turn on the current the electric bulb will always operate at approximately the correct brilliance. Of course, there are slight fluctuations. Around supper time, when everybody seems to turn on the light at the same hour, there is usually a slight drop due to the sudden load on the power house.

This slight variation does not compare with the fluctuations in the ordinary storage or dry cell type of A-battery. When fully charged, a three-cell storage battery may develop nearly seven and a half volts. This pressure drops rapidly to six volts and then slowly to about five and a half volts, at which point the battery should be recharged.

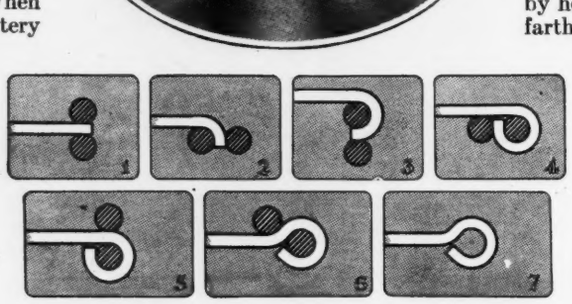
Vacuum tubes are much more delicate than electric light bulbs, and to get satisfactory service it is necessary to operate them at close to the right voltage. The manufacturers, therefore, make the tubes to operate at five volts, so that you can always get theright voltage by adjusting the rheostat.

Those Dangling Wires

IT ISN'T necessary to have a lot of wires dangling from your radio set to the batteries underneath the table. Modern factory built sets are often supplied with a battery wire cable that includes all the necessary wires for A-battery and B-battery connections. If you have a home built or factory built set that is not fitted with a cable, you can bundle all the wires together and tie them every few inches with a piece of thread, as shown in the illustration at the bottom of the page. If you expect to bundle the wires together in this fashion, it is desirable, of course, that you use something more substantial for connecting the batteries than ordinary bell wire.

How to Form Loops

THE terminals of sockets, transformers and other radio instruments are fitted with binding posts or soldering lugs, and often with both, so that you can choose between the two methods of making connections in building your radio.

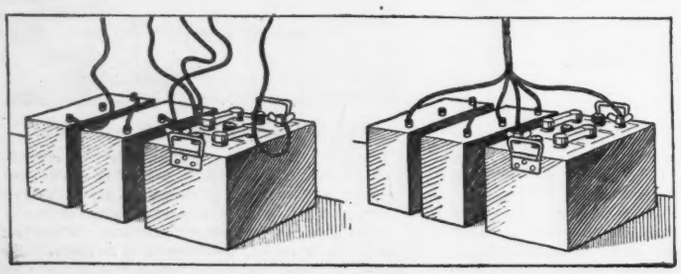


Binding Post Connections Are Easy This Way

In Fig. 1 the extreme end of the wire is grasped between the jaws of the round nose pliers. In succeeding illustrations, the wire is first formed into a loop and then bent part way backward to get center of the loop in line with the center of the wire

Properly made binding post connections are just about as good as soldered connections for radio sets. That is true, however, only when stiff wire is used, as it is difficult to clamp the end of a flexible, stranded wire under a binding post so that it will stay put.

The illustration in the center of the page shows how to bend the end of a piece of bus wire to fit over a binding post screw. With a pair of round nose pliers, you can shape up a perfect eyelet in the end of the wire. The size of the opening is regulated by holding the end of the wire nearer or farther away from the nose of the pliers.



Cabling your battery wires as suggested here makes a neat installation and actually promotes efficiency. Excess wire in stray loops is often the cause of regenerative feedback effects that spoil the quality of reproduction in a set

A B C's of Radio

THE grid leak is an important unit in the circuit of a vacuum tube radio receiver. Without it the tube will not function properly in receiving the broadcast music or speech. And if the grid leak is of poor quality, but of approximately the right value of resistance, the broadcasting may be received with full volume yet with so much noise that reception is ruined.

When the resistance of the grid leak is too high, the detector tube overloads on any but the weakest signals, and distortion results. Too high resistance at this point also makes regeneration hard to handle, so that when you turn the knob that controls the regeneration (often marked "volume" or "intensity") the tube suddenly starts to howl, and the noise cannot be stopped until the dial or knob is turned a considerable distance toward zero. Too low a resistance means weak signals.

A sizzling and crackling noise in the set is often due to a poor quality grid leak that constantly changes in resistance value, making the flow of current irregular.

Crystal Set Range Limited

RADIO beginners often spend hours and hours attempting to get long distance and loud volume out of a crystal set.

There is, of course, a great difference in the sensitiveness of crystals, but the maximum volume is strictly limited by the actual strength of the radio impulse that reaches the crystal by way of the antenna. All that any crystal can do is to rectify this signal and pass it on to the headphones. The vacuum tube, on the other hand, not only rectifies the incoming signal, but also draws current from the B-battery to reinforce it by regeneration in the detector tube, or to amplify it when the tube is used as an amplifier.

The vacuum tube is really a trigger that is pulled by the incoming signal to release many times the original energy from the B-battery.

You Can Use Storage Batteries

JUST because your radio set is designed for use with the dry cell type of tube does not mean that you can use only dry cells to light the filaments. A one-cell storage battery will operate the single dry cell tubes, and a two-cell storage battery will light the filaments of the tubes built to run on three dry cells in series.

Of course the substitution of a storage battery for the dry cells is only worth while when there are means at hand for recharging. No change in the rheostats or internal wiring is necessary.

RADIO Personality—

Have You Got It? These Men Found They Had It, and Became Famous

COULD you fill the job of radio announcer at a broadcasting station? Besides possessing a "radio" voice, you would need an amazing combination of other qualifications. You would have to be a musician so you could step into the gap yourself with a song or instrumental solo when the scheduled artist failed to appear, for even a minute's delay will cause thousands of fans to reach for the dials and tune-in some other station. Diplomacy, social polish, quick wit, and a wide range of general knowledge would also be necessary, to enable you to preside over the microphone at any function from the inauguration of the President to a prize fight.

Could you qualify?

Radio's Pioneer Announcer

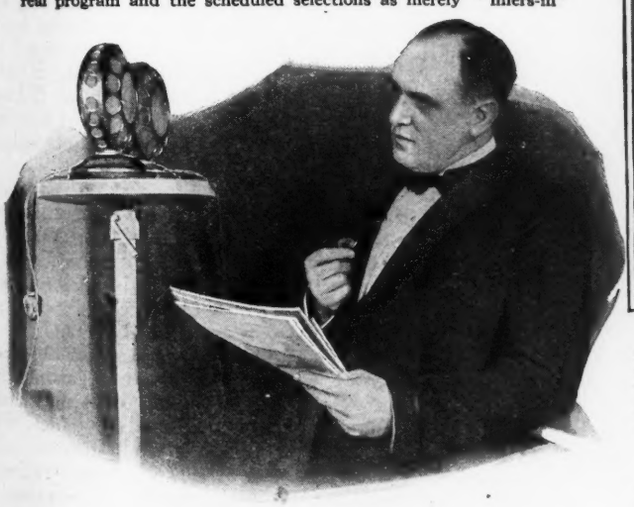
Back in the days when announcers were known to the radio audience only by letters, Milton J. Cross (above) established a reputation as the possessor of a voice that went through the microphone to the listener's ears without losing any of its rare, pleasing quality. His popularity has never waned. The job of radio announcer was a brand-new one then. Today young men hankering after the same job join voice culture and public speaking classes and whatnot, but the pioneers like Cross had to be their own teachers

The Bedtime Story Man

Walter Wilson, left, one of the announcers at station KYW in Chicago, is a favorite with children who have listened to his bedtime stories. An instinctive knowledge of what appeals to children, and a gift for story-telling, explain "Uncle Bob's" success

"Roxy" Gets Close to His Audience

S. L. Rothafel (below), known to millions of radio fans as "Roxy," has made a sensational success of his announcing by cutting out the formal, cut-and-dried phraseology and talking to his unseen listeners as though he knew each one of them personally. So popular is his announcing that his most ardent admirers regard "Roxy" as the real program and the scheduled selections as merely "fillers-in"



No Hitch in the Program Catches Him Napping

In Detroit, C. W. Kirby (above) of station WWJ has built up a remarkable reputation for versatility. It is said that he can fill in a delay of almost any length in the program so interestingly that the listeners do not tune him out in favor of some other station. No matter what happens, Kirby is always on the spot—and always with the right idea

Describing the Game

Major J. Andrew White (above) was among the first to popularize the reporting of great sporting events play by play to distant radio listeners-in

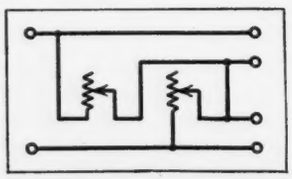
Graham McNamee of Station WEAF

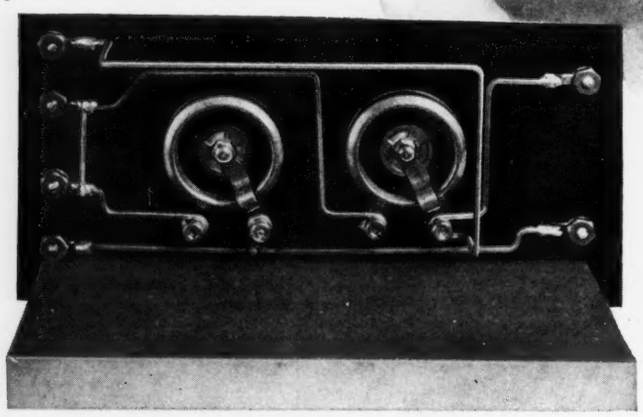
The name of no other announcer in the world today probably is known to so many listeners as that of Graham McNamee (right). His knowledge of human affairs is remarkable—whether he is broadcasting a political convention, musical program or prize fight, he knows his subject

A Fascinating *New* Radio Trick

How You Can Blend the Tones of Two or More Loudspeakers, with Surprising Results

By John Carr





The "Mixing Panel" Is Easy to Make

In the front view (upper picture) the left-hand binding posts are connected to the output of your radio set, and the tips from the two loudspeakers are connected to the upper and lower binding posts at right

HERE is an easily built radio accessory that will enable you to make some interesting new experiments with loudspeakers. And it certainly will improve the quality of your radio reproduction unless you already own a loudspeaker that gives uniform volume on musical notes throughout the audible scale.

In a broadcasting station, the section of the control mechanism that makes it possible for the operator to regulate the strength of the pick-up through each microphone when several are in use is termed the "mixing panel." The term accurately describes the device shown on this page. By using it with two loudspeakers of different types, you can adjust the volume from each of them so that the combined effect will be more pleasing to your ear than the reproduction of either loudspeaker if used alone.

This means, for instance, that you can connect up a small tin-horn loudspeaker to one pair of binding posts and a big fiber-horn speaker to the other pair. Then, by turning the knobs of the variable resistances, you can blend high notes from the little speaker with throaty, deep-toned vibrations from the big horn.

You will find that a different adjustment is needed for each type of musical instrument when played alone, and you must make some change even on bands and orchestras to compensate for variations in the placing of the various instruments in relation to the studio microphone.

The effect of this mixing on the human voice is even more marked, particularly the speaking voice. Higher pitched sounds in the speaking voice determine the ease with which it can be understood while the deeper tones give the voice its pleasing resonant quality. That is why it is possible to understand every word reproduced by a raspy, tinny loudspeaker while the same words coming out of a large horn are difficult to understand, although the quality is in the latter case more pleasant to the ear. With a mixing panel you can balance things so that the voice sounds natural, and when static is heavy you can emphasize the high-pitched tones to make the voice more understandable.

ANOTHER valuable use for this mixing panel is the elimination of the directional effect that is so pronounced with some types of loudspeakers. With it you can place two loudspeakers at widely separated points in the same room and then regulate the volume from each one so that the listeners will be unable to tell from which direction the music is coming.

Still another use is to adjust the relative volumes of two pairs of headphones when both are being used, so that each listener hears the music or speech at the desired volume. This is particularly helpful if one of the listeners is hard of hearing.

You will have to build this mixing panel yourself. There is no such article to be obtained in the radio stores, although nearly every store sells the simple parts from which it is assembled. The construction, however, is easy even for the man who has never done any radio assembling.

What the mixing panel does is to connect the two loudspeakers in series with a variable high resistance shunted across each one. The only parts needed are two variable resistances and six binding posts. If economy is important, you can use a piece of dry wood for the panel. The resistances mounted on the mixing panel shown in the illustrations are of the 0 to 500,000 ohm type. You can solder the connections or use the binding posts supplied on the resistance units.

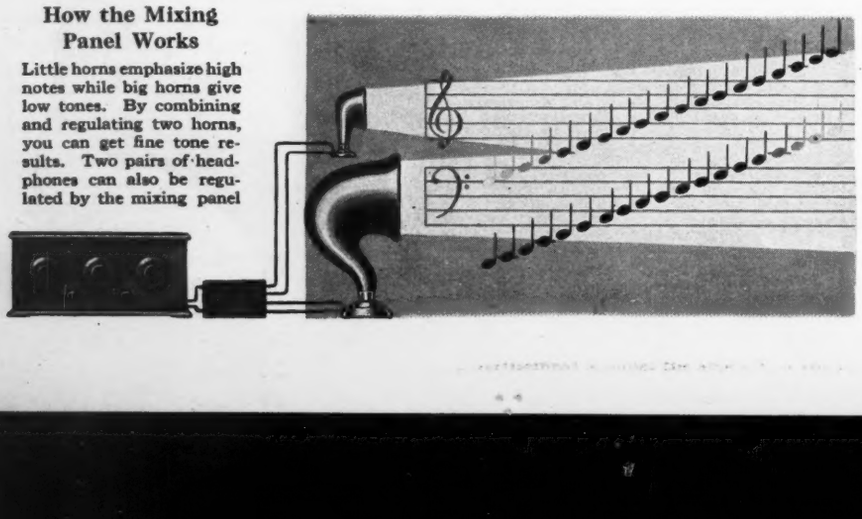
The mixing panel shown in the illustrations is designed to control two loudspeakers, but it can be constructed to handle three loudspeakers, too. Simply make the panel large enough for the additional variable resistance and binding posts needed for the third loudspeaker.

OBVIOUSLY, the mixing panel is most useful with two loudspeakers of totally different characteristics. As shown in the illustration, the combination of a small tin-horn speaker with a large size fiber-horn affords the greatest opportunity for variation in tone effects.

Doubtless you have argued at great length with your neighbors regarding the relative quality of your own and their loudspeakers. The mixing panel will enable you to make comparisons that clearly show how one speaker differs from another. By connecting up the two speakers to be compared and turning one off as you turn the other on, your ears will be able to distinguish very clearly the changes that take place in the tone quality—far more easily, in fact, than if one loudspeaker is shut off completely before the other is turned on.

How the Mixing Panel Works

Little horns emphasize high notes while big horns give low tones. By combining and regulating two horns, you can get fine tone results. Two pairs of headphones can also be regulated by the mixing panel



Installing a Wave Trap

If you live near a powerful broadcasting station that drowns out all other stations on your dial, a wave trap may solve your problem. In the picture at the right, a service man from one of the big stations is showing a listener-in how to tune out his own station by using a wave trap

How to Use a One Stage Amplifier

One of the latest types of factory built one stage radio-frequency amplifiers is especially useful in improving the selectivity of a regenerative set. It has another advantage in that it adds to the sensitiveness of the set on distant stations

How to Increase Selectivity and Your Chances of

Getting the Station You Want

Wave Traps, Amplifiers, Antenna Changes, May Help

By ALFRED P. LANE

SELECTIVITY as applied to radio sets is purely a relative term. It is all a matter of the conditions under which the set is working. So the problem of increasing the selectivity of your radio receiver may have one solution if you are using a certain length of antenna in one locality, or a totally different solution if you live somewhere else.

The fact that so many broadcast stations are assigned to the same wave length, especially on the lower end of the scale, accounts for some difficulties you may be having in choosing between stations. In addition, the broadcasting stations sometimes stray from their proper wave lengths, creating interference that will bother you no matter how selective your radio set happens to be. For if the broadcasting from two different stations is actually on the same wave, it is obvious that there is no way to separate them.

There are theoretical rules and formulas that can be used to determine what an ideal antenna should be like. Unfortunately, however, no formula could possibly take into account the wide variety of conditions under which amateur radio antennas are constructed. You will have to do your own experimenting to find out what type of antenna will give the best results for selectivity and distance.

REMEMBER that a short antenna always gives greater selectivity than a long one, and that a horizontal antenna sometimes shows considerable directional effect. It usually gives the most volume on stations located in the opposite direction from the free end.

The effect of a short antenna often can be obtained by connecting a fixed condenser of .0001 mfd. capacity between the antenna lead-in and the antenna binding post of your set.

Completely shielding the receiver with sheet copper or tin foil will often improve the selectivity also. To try it, simply paste sheets of tin foil all over the inside of the cabinet and as much of the panel as possible without short-circuiting any of the instruments attached to it. Make sure that all of the sheets of tin foil are in metallic contact with each other and with the ground terminal of the radio set.

The circuit of Fig. 2 shows a very effective wave trap that can be assembled quite easily by the radio fan who likes to build his own apparatus. The variable condensers K and N should be about .00035 capacity if coils J and M consist of sixty to sixty-five turns of No. 22 double cotton-covered wire wound in a single layer on a three-inch form. Coil L should be about six to eight turns of the same size wire wound next to coil M on the same form. Completely shielding this wave trap by mounting it in a tin foil lined box is desirable for best results.

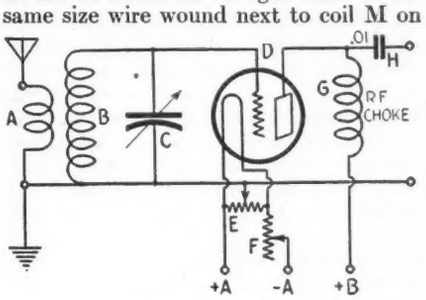


Fig. 1. A useful circuit for a one stage radio amplifier, requiring no changes in the set

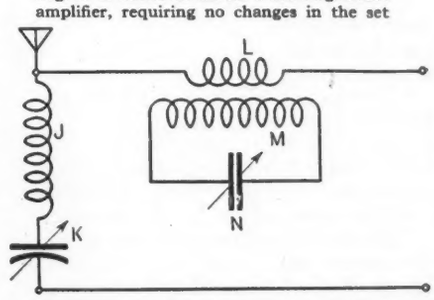


Fig. 2. Circuit for a home built wave trap. It is useful close to high-power stations

The use of a factory built or home constructed wave trap of this type will help eliminate interference on all types of sets that include a stage or two of radio-frequency amplification, such as the five-tube neutrodynes and others.

BUT if you own a set that has only a regenerative detector tube in front of the audio amplifier, the first and most important way to improve its selectivity will be to buy or build yourself a one stage radio-frequency amplifier unit. The home builder will find the diagram of Fig. 1 a help. It shows a one stage radio-frequency amplifier that can be attached to the regular antenna and ground binding posts of the receiver without making any changes in the wiring of the receiver.

If you are interested in home built radio apparatus, the parts should consist of coil A, six to twelve turns of No. 22 double cotton-covered wire wound on a three-inch form next to coil B, which should be sixty to sixty-five turns of the same wire if variable condenser C is of .00035 mfd. capacity. D is a standard vacuum tube of the storage battery or dry cell type. E is a 200-ohm or 400-ohm potentiometer. F is a twenty-ohm rheostat for the 201A tube, thirty-ohm for the 199 type or six-ohm for the 11 or 12 type. G is a standard type of radio-frequency choke coil or a spool wound with 600 turns of No. 32 insulated wire.

Be careful not to wind the wire in smooth layers. It should be jumble wound. H is a fixed condenser of about .01 mfd. capacity. The outfit should be mounted in a shielded cabinet or box.

Factory built wave traps and one stage amplifiers have been approved by the Popular Science Institute of Standards. You may obtain the list of all approved radio apparatus without charge.

What Poor Oil Does to a Car

How a Few Pennies Saved May Mean Dollars Wasted on Repairs

"Look at your cylinder head and pistons," said Gus. "The carbon is crusted on nearly a quarter of an inch thick. The valves are pitted, too. That's what a poor brand of oil will do to a motor!"

By MARTIN BUNN

"PHEW! That fellow must be burning soft coal instead of gasoline!" whispered Joe Clark to his partner, Gus Wilson, as the latter walked out of the Model Garage in response to frantic blasts from a motor horn at the curb.

The car which had stopped there was emitting dense blue-black smoke in such tremendous volume that the two garage men were nearly suffocated as it drifted into the garage.

"My name's Potter," began the owner of the car, shutting off the motor as Gus approached. "I've just moved into town, and my neighbors tell me you're the man to see when an auto needs fixing. And this car sure needs something done to it. It's got no power or speed, and it runs rotten all the time. Besides that it starts hard. Look her over and see what's the matter."

Gus raised the hood and inspected the level of the oil in the crankcase. Then he asked for the hand crank and carefully tested the compression in each cylinder.

"Where did you get that oil, Mr. Potter?" he inquired.

"It's 'extra refined' oil and I got it at a great bargain," Potter answered. "Costs me only thirty cents a gallon in fifty-gallon drums shipped right from the refinery."

"Well, I don't like to discourage you," said Gus, "but using that particular grade of oil has put this engine on the blink for fair."

"What do you mean?" snorted Potter indignantly. "I've been using that oil right along, and I never had any trouble with it before."

"THAT'S because it takes a while for the bad effect of poor oil to show up in the running of the engine," Gus explained. "You can use poor oil and get away with it for a time, just as you can neglect your storage battery without trouble until the battery quits cold and leaves you stranded on the road.

"Motor oil has to do only one job—keep the moving metal surfaces from rubbing against each other. And it takes mighty good oil to do the job right. The film of oil between the moving metal parts in an engine is thinner than the thinnest sheet of tissue paper, and if the oil is of such poor quality that the film breaks at any point, the bare metal surfaces will rub against each other and some of the metal will be worn away.

"Plenty of poor oil is better than no oil at all because, if the oil film does break down, it is renewed by the fresh supply and the wear is slow. That's what has happened to this motor. The oil you are using is poor grade, but you have evidently kept the crankcase level up to the proper mark and so it's taken time for the wear to put the motor on the bum."

"How do you know the oil is no good?" questioned Potter skeptically. "You don't mean to tell me you can tell poor grade oil just by looking at it!"

"OF COURSE not," admitted Gus. "Nobody—not even an oil expert—can be sure about the quality of oil just by looking at it. The color of an oil doesn't mean much. I can show you two different oils, one dark and one light, that show up exactly the same in the standard tests. Also, they are equally good for motor lubrication. Even the thickness or 'body' of a cold oil doesn't prove much. The important point is whether the oil will get too thin at the high temperature of a running motor.

"Your motor has all the earmarks of poor lubrication. Besides that, I know that high-grade oil can't be bought for the price you paid.

"Gas engine oil gets a lot of rough treatment inside the motor, you know. It has to be thin enough to run in between closely fitted bearings and yet stand terrific heat without getting so thin that it will be squeezed out by the pressure.

"Cheap oil is often a mixture of what the refiners call 'tops' and 'ends'—the lighter oils that come off first when crude oil is distilled with enough of the heavy parts that come over last to give it about the right body. When you lubricate a motor with such stuff, the lighter oils evaporate into clouds of smoke and the heavy portions turn into carbon and gummy deposits.

"That's what's the matter with your motor. It's chuck full of carbon. The valves are all gummed up and probably burned and pitted. And because the oil is such a poor lubricant, the piston rings are worn so that the compression is no good. The bearings need taking up too."

"I can hardly believe it's as bad as all that," said Potter.

"All right," said Gus. "Come around tomorrow and I'll show you just what the inside of your motor looks like and you can judge for yourself."

Potter showed up promptly the next morning.

"I had it sized up about right," said Gus as Potter strolled in. "See—here are the piston rings. Every one has blackened surfaces where it ought to be bright. Those dark areas are where the gas is rushing past the piston into the crankcase. Look at that cylinder head and the tops of those pistons. The carbon is crusted on nearly a quarter of an inch thick. These valves are pitted to beat the band. And see how the carbon has baked on to the stems until they won't seat any longer."

"YOU win!" admitted Potter. "It's a mess all right. Anything else wrong?"

"The bearings are pretty loose," Gus replied. "I'll have to take them up. And the cylinder walls are burned and slightly scored, but I think the cylinder hone will clean them up easily enough. That's about all, but if you have any lingering idea that the oil you were using is good just look at the gummy deposit sticking to the oil pan."

"Humph!" groaned Potter. "Counting in the cost of these repairs, that oil will cost me about two dollars a gallon."

"Pretty expensive oil," said Gus. "You can buy the best on the market for a whole lot less. And I'd do it hereafter if I were you."

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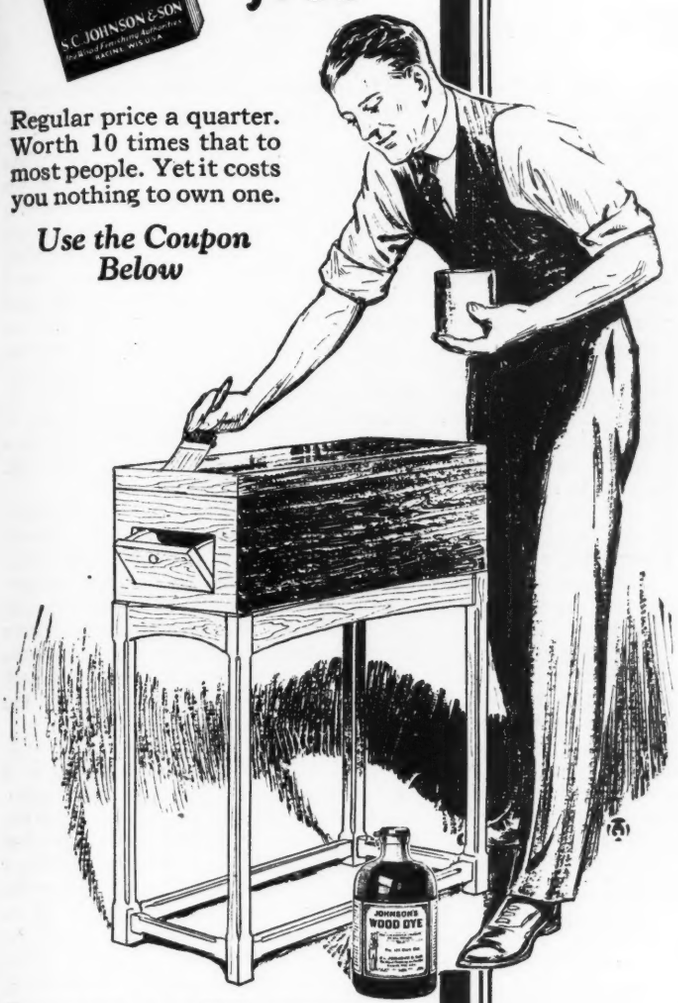

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Useful Ideas for the Autoist

A Gong Device to Save You Waits at the Gasoline Station — Simple Tail-Light Cushion — Other Kinks

IT IS certainly annoying to drive up in front of a gasoline pump and then have to blow your horn again and again until someone comes out to fill your tank. If you have had this trouble, why not suggest a remedy to the owner of your gasoline station? As worked out in a western filling station (Fig. 1), the idea is very simple.

The board opposite the pump was taken up from the wooden driveway and set in place again with a hinge at the end farthest from the pump. Then a single-stroke gong was mounted on the side of the pump housing in such a way that a cord could be run from the bell lever down to the end of the board.

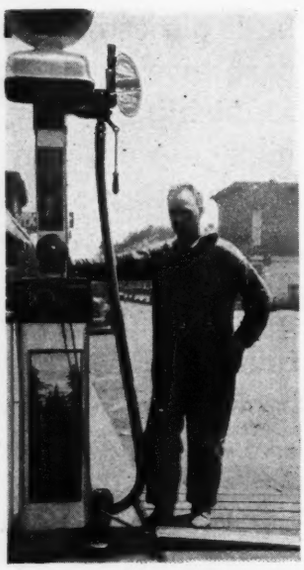

Fig. 1. The front wheel of the car, rolling over the loose board, rings the bell and calls the gasoline pump attendant. One clang brings him

When an auto drives up, the front wheel depresses the board and so rings the bell. One clang will always bring the attendant on the run, while he might be deaf to the sound of the auto horn simply because he hears auto horns continuously. The bell means just one thing to the service man: Somebody wants gas!

The same idea could be used in connection with an electric bell located inside the service shop. In that case the hinged board should be connected to a switch of the type used for stop lights.

A DENT in the mud guard of your car is not pleasant. At the same time, it does not interfere with the operation of the auto. But if some other motorist bumps into you in such a way that the tail-light is broken, you are likely to get a ticket from the police officer before you discover the damage.

A neat way to insulate the tail-light against jars and bumps is to mount it on a piece of rubberized fabric as shown in Fig. 2. A piece cut from an old auto tire will do. The lower end of the piece is bolted where the light was, and then the latter is bolted to the top so a jar will bend the fabric instead of smashing the light.

Arrange wire connection with enough slack so that bending bracket will not break wire.

FORDING a creek with an automobile successfully depends on whether or not the water gets at the ignition to short-circuit it. One way of protecting the high tension wires that lead from the distributor to the spark plugs is to fit a section of old inner tube as shown in Fig. 3. The lower end should be tight enough so that water cannot leak through.

Of course this arrangement would be of no particular use except in cases where the distributor is located rather low on the side of the engine. If it is as high as the air intake of the carburetor, there would be no use in fixing the distributor, because the motor would be stopped anyway as soon as water started to flow into the air intake.

In such a case it would be necessary to fit a water-tight pipe over carburetor intake with opening up near cylinder head.

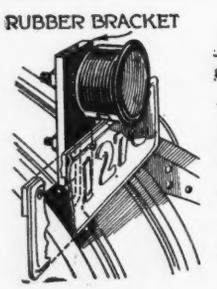

Fig. 2. A rubber bracket saves your tail-light from being smashed in minor rear end bumps

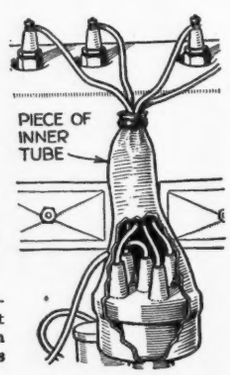

Fig. 3. A timer covered with rubber in this way operates under water when fording rivers

Fig. 4. Keep always before you a record of the last time the car was lubricated so that you will not easily forget when it was done

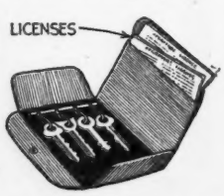

Fig. 5. If you keep your auto keys in a key container, you can keep the licenses in the pocket, and always have them with you

ONE simple way to remember when you lubricated the car last is shown in Fig. 4. A piece of celluloid is cut in a strip narrow enough so that it will not cover the figures on the speedometer dial. The cover of the instrument is unscrewed and the slip placed between the rim and glass so it will be against the glass but on the outside. Then you can jot down on the strip the speedometer reading when you go over the car and thoroughly lubricate it. Allow the figures to remain as a warning until the next time, when they can be erased and new figures inserted.

TO MAKE sure that your automobile driving license and car license will always be on hand when you are in the car, use one of the folding leather key containers for your automobile switch keys (Fig. 5). You can put the license for each member of the family in the pocket of the same container. You can't start out in the car without the keys, and the licenses will always be with them.

CLEANING the top of the car is a nuisance, and consequently many auto owners neglect the job until the top gets exceedingly shabby. An ingenious way to keep the top clean is to fasten a strip cut from an old blanket across the garage just inside the door (Fig 6), so that every time you drive in or out the top will be brushed off. The lower edge of the strip should extend considerably below the lowest part of the top.

UNLESS the needle valve that is controlled by the float in your automobile carburetor is absolutely tight, you will find it worth while to shut off the gasoline between the vacuum tank or main tank and carburetor whenever you are going to leave the car standing idle for several days at a time. This will prevent wasting gasoline through a slow leak.

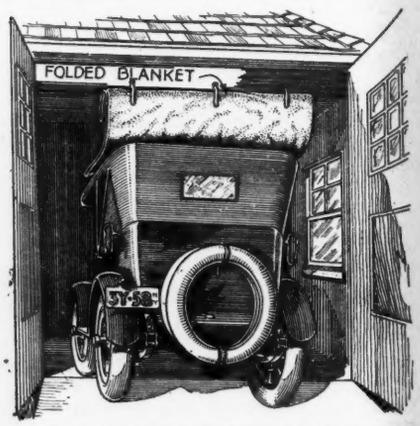

Fig. 6. An auto top cleaner of this type works automatically and will save you a lot of bother. Use a blanket or soft material

Ten Dollars for an Idea!

CLIFTON E. JACKSON, of Los Angeles, Calif., wins the $10 prize this month for his suggestion of a bracket to protect your tail-light (Fig. 2). Each month POPULAR SCIENCE MONTHLY awards $10 in addition to regular space rates to the reader sending in the best idea for motorists. Other contributions that are published will be paid for at usual rates.

Why build *four* floors— then live in only *two?*

MAKE ALL your house livable. Line your attic and cellar with Upson Board. Add 20% to 30% more living space; cut 20% to 30% off your coal bill.

WHY leave half of your house a "no man's land?"

In your attic, apply Upson Board direct to the studs. Then build in a maid's room, a cozy play room, a comfortable work room.

Valuable new living space! And at the same time you insulate your home—make it winter-warm, summer-cool——save from 20% to 30% of your expensive winter fuel bill.

Give your cellar a chance, too

Partition off your furnace—line the floor boards—to keep dust from seeping through the house.

Build in a fruit closet—or other needed rooms.

Keep your washing clean by building in a laundry with Upson Fibre-Tile—a special Upson Board with tile-like indentations in the surface. Enameled, it builds washable, tiled wainscoting for laundry, kitchen or bath—and at about 1/10th the cost of porcelain tile.

A nearly perfect building material

You'll like Upson Board!

You'll like the clean, lumber-like panels—light enough for one man to handle, yet so strong and sturdy they can never crack or fall.

You'll like the way it saws and cuts—and Upson Board has none of the dampness and irritating muss of plaster. Upson Board is not like ordinary wallboards. Impartial laboratory tests show that it withstands from 40% to 150% heavier blows than other boards tested.

Dozens of letters in our files prove that Upson Board resists moisture, steam—even ordinary leaks—and offers splendid resistance to fire. Properly applied, it should never warp or bulge and should last as long as the building stands.

New to the few, Upson Board is old enough to be approved by use in over a million buildings, with less than one complaint to every 8,000,000 feet sold and used.

Write for suggestions

Let us show you how Upson Board could reclaim your home's waste space. We invite you to mail the coupon for samples, literature, and full-size blue print.

When you buy, be sure to get *genuine* Upson Board—easily identified by the blue center in panel edges. Handled by discriminating lumber dealers everywhere.

UPSON BOARD IS DIFFERENT

Won't warp or bulge. Use in over a million buildings proves that, properly applied, Upson Board should never warp or bulge—should lie flat on the wall as long as the building stands. Impartial tests prove Upson Board 40% to 150% stronger than other boards tested.

No ugly nail-holes. Upson Board is the only wallboard that can be applied without ugly nail heads or marks on the finished surface. Upson Self-Clinching Fasteners, a patented, exclusive Upson invention, anchor Upson Board invisibly from the back.

Waterproofed—fire-retardent. Dozens of letters in our files prove that Upson Board resists moisture, even ordinary leaks, and offers an effective barrier against fire.

UPSON PROCESSED BOARD

FOR WALLS..CEILINGS..PARTITIONS..INSULATION

The Upson Company
927 Upson Point, Lockport, N.Y.
Enclosed find 10c for samples, literature, and full-size blue print for (kind of room)

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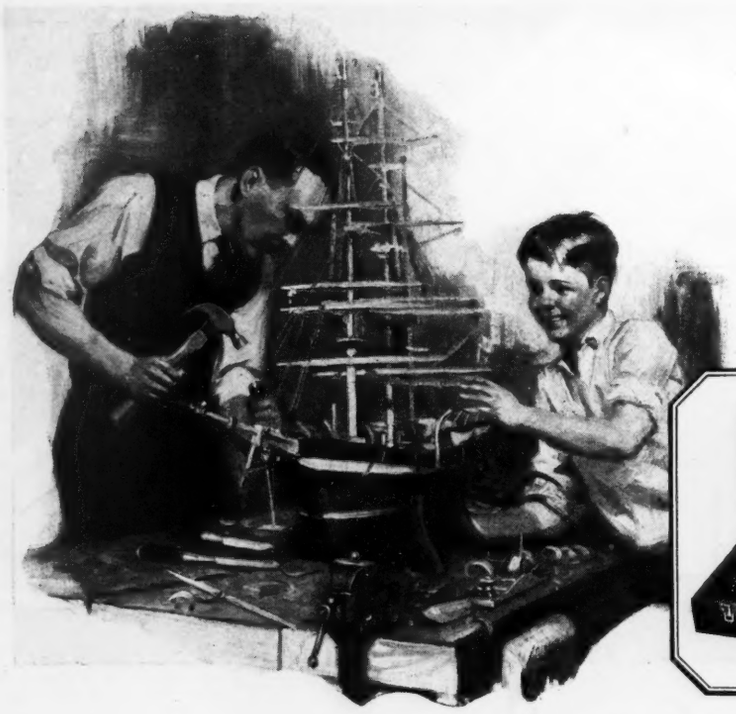
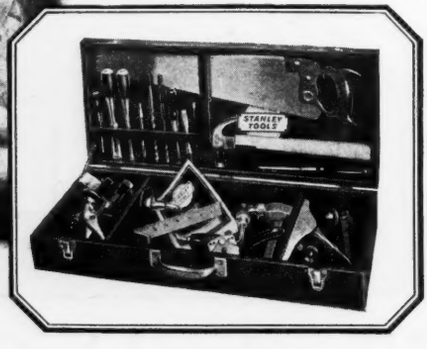


Buy separately or in assortments



Father & Son—partners!

SAID a happy father recently, "I can't think of anything I ever bought for my boy that worked out better than our Stanley Tool Set. We've had a lot of fun working together.

"We started with a few simple repairs about the house. Then we made our own work bench; after that a table. Now we have just started on our most ambitious effort—a model of an old galleon—and already it looks like a success."

Such work requires good tools. Stanley Tools have been standard for more than a half century. You'll find them in most carpenters' kits and in manual training classes throughout the country.

You can buy Stanley Tools separately and gradually accumulate your set. For your convenience in buying, there are also sets in fine oak chests from $15 to $95. Or there are assortments of the same good tools in strong cardboard boxes containing simple directions for making your own chest. Prices $5 to $20.

Ask your hardware dealer to show you the line of Stanley Tools. And send for our Catalogue No. 34 which describes Stanley Tools both separately and in assortments. Address: The Stanley Works, New Britain, Conn.

The best tools are the cheapest to use
Ask your hardware dealer

STANLEY TOOLS

THE MOST COMPLETE LINE

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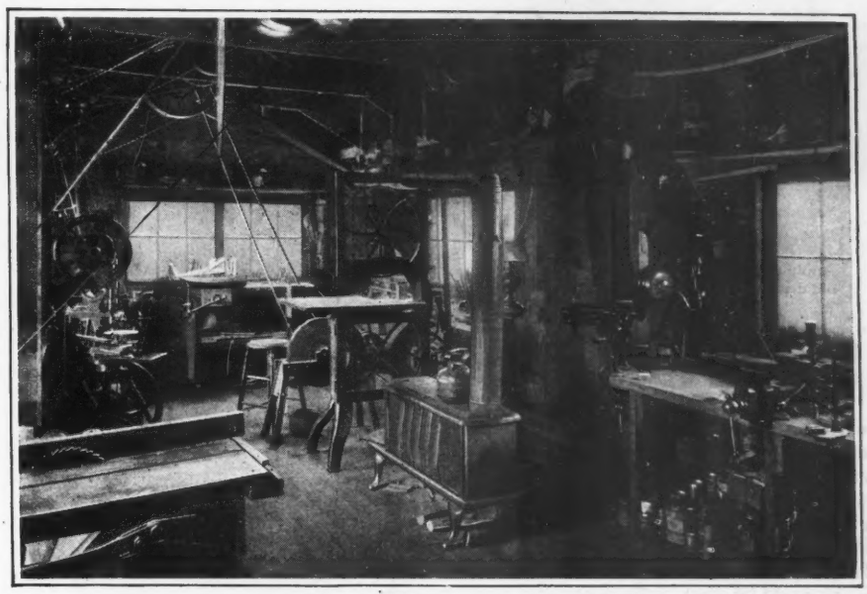
The Home Workshop

Arthur Wakeling, *Editor*

My Adventures in Toolcraft

An Expert Tells How He Built Miniature Railways and Merry-Go-Rounds, and Reveals His Tricks for Simplifying Construction

By Edward Thatcher



In contrast to his present shop (above), Mr. Thatcher for years did practically all his lighter work in a 4 by 7 ft. room. A later article will tell exactly how he fitted up that most remarkable little shop

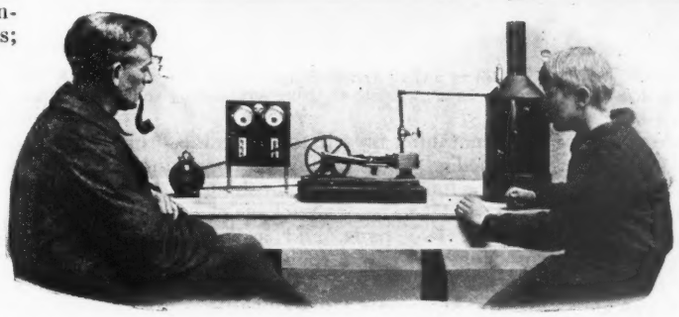
AS LONG as I can remember I have had some sort of a shop and real tools to work with. These shops have helped me in many ways and have led to many interesting adventures in the realm of craftwork.

Christmas time, when I was seven years old, I shall never forget running down to the Christmas tree in the very early morning. The very first thing I saw was a marvelous workbench, a real one; a carpenter's bench in miniature, with a vise on it, a bench stop for planing, shelves in each end for tools; everything as it should be.

This was long before the days when manual training benches were sold at the stores. My father had had a clever local cabinetmaker build it for me.

There was a marvelous chest of real tools to go with it; and, to top off the beginning of a perfect day, there was a dandy toy steam engine with a brass boiler and a bright red flywheel. I still have that engine and it runs for my boy, Mike, and for me.

A little later on one of the attic rooms was turned over to me for a shop—my first real shop, a place of my own, where I could go and work, Saturdays and after school. I still remember the thrill of it.



Playing Engineer and Fireman

This miniature electric generating plant is one of many toys Mr. Thatcher has assembled for his son. Who gets the more fun out of them is a question. Mr. Thatcher invented a method of tin-can toy making used extensively in reconstruction work for wounded soldiers. For fifteen years he was an instructor of decorative metal working at Columbia University

MY FATHER and grandfather were in the painting and decorating business and drove about the country to oversee many different jobs. Often I went with them and watched work being done by skilful workmen—carpenters, masons, plumbers, painters, and, only occasionally, an electrician.

Then, too, there was the large "store" in town where our men worked at sign painting and other things. There it was a great pleasure to watch my father do an occasional difficult piece of work, for he was, and is, one of the most skilful craftsmen I have seen. My mother, too, was very skilful in making things, particularly in making something old and valueless into something new, useful and attractive. Always our motto was, and still is, "If you haven't it, make it!"

I well remember helping gild with gold leaf the great eagle from the top of the town flagpole and the thrill of hearing my father tell of an early morning climb to gild the ball and weather vane on the steeple of our old church, which church George Washington had attended.

One of the first things I recall having made was a semaphore signal. The signal arm was sawn from cigar box wood. Red paper was pasted over one end of it for a lens, and a candle end was stuck on a shelf mounted on the post behind it.

And then there was a toy gravity railroad.

The construction was very simple, as shown in one of the drawings on page 96 (Fig. 1). The track (A) consisted of wooden strips nailed to boards, the boards being about 6 in. wide. The rails were tongued strips ordinarily used as slides for window screens. Wooden strips ¼ in. square in section might well be used for the rails, as it may be difficult to get the tongued strips now. When laying the track it is convenient to use the gage shown at B.

THE general layout of the gravity railroad is shown at C, Fig. 1. One end was elevated and rested on a box.

A plan of a simple switch is given at D. A section of the track is made movable, so that one end of it may be shoved over opposite either of the switch tracks. A wooden lever is connected to the switch with a link of wire, nails being driven in the board underneath the track and used as stops. The frog consists of a small section of track cut carefully to a sort of diamond shape (*Continued on page 96*)

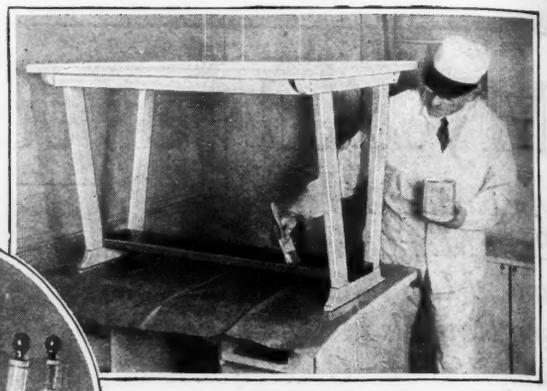
The Magic of Brush Lacquering

How You Can Use the Quick-Drying New Finishes for Beautifying Floors, Furniture and Woodwork

By Ralph G. Waring

Specialist in Furniture and Auto Finishes

Applying green lacquer to the handles of an old desk made over into a kitchen worktable



Mr. Waring lacquers the foot rail of the breakfast table brown to match chair seats

Finishing a chair seat with dark brown lacquer. Note the knobs and clean-cut banding

"GOOD morning, Dan. How did your mother like the brushing lacquer work you did for her?"

"Fine, Mr. Waring. She was so pleased with the quickness with which the lacquer dried and its fine appearance—how it stands washing and everything—that she wants me to do a lot more refinishing about the house. She told me to ask you if it would be all right to use a light gray lacquer on the kitchen floor. She thought ivory could be used for the breakfast room set to match some ivory enameled pieces we have. Perhaps we could have sage green for a trimming color. Would the lacquer stick to the brown china knobs on the kitchen doors? The brown knobs don't go well with the new pale ivory enamel on the rest of the woodwork."

"Well, Dan, here is a good brand of lacquer, which I have been analyzing. It will do just what you ask. I think that it will be a clever idea to cover the brown china knobs with this jade green lacquer to match the chair trim. When I was at your house the last time, I noticed that the knobs on the kitchen cupboard catches were looking quite worn, so don't you think it would be a good idea to lacquer those green, too? It would trim the cupboards nicely to have the green knobs with the ivory doors.

"DO YOU know, Dan, I believe I will make a test job of this and we will go over to your house together so that I can check the conditions as we come to them. It won't take so very long. You take these cans of pale ivory, jade green and light gray, and a can of thinner. Better get a pencil brush of soft hair, one brush an inch and a half wide, and a three-inch fitch varnish brush."

We drove over to Dan's house where the affable Mrs. McChesney greeted us with her ready smile of welcome.

"'Tis fine of you to help my Danny so much, Mr. Waring. He gets a grand chance to learn his trade with you."

"Well, Mrs. McChesney, I expect to learn something myself this morning," I responded. "There is always something new to be found out about finishing work. If you will let us have a package of scouring dust, two pails, and a scrubbing brush, together with a sponge, we can get ready for work."

While Mrs. McChesney was getting these, I told Dan how necessary it is to clean the old finish over which colored, or pigmented, lacquers are applied. No lacquer will adhere to a greasy surface.

In lacquering a floor, brush only one way, from the finished to the unfinished surface

"Do you recall the lacquer floor test we made, using varnish remover to take off the old finish?" I asked Dan.

"Yes. That was the time the lacquer didn't get hard for about ten days."

"I found out the reason, Dan. You remember how carefully we washed the work with denatured alcohol after using the varnish remover. Well, it wasn't enough to remove every trace of wax from the cracks between the boards. Varnish removers have paraffin in them, you know, to delay evaporation. Varnish apparently is not affected by the trace of wax left in the cracks, since it hardens on schedule time. On the other hand, the powerful thinners used in lacquer take up the wax, dissolve it, and permit it to come to the top of the lacquer film as it starts to dry. The thinners penetrate this film of wax so slowly that in this particular case it took ten days to dry, when an hour should have been ample. When I applied a second coat afterward, it took three days to harden properly. Rather surprising for material which is supposed to be ready to walk on in an hour! So, to clean the remainder of the floor for the test, I tried a well-known brand of scouring dust and also a common commercial cleanser that acts on oils and grease by emulsifying them and, therefore, is easy to rinse off. Both of these proved to be excellent. After their use the lacquer dried in from fifteen to thirty minutes and was ready to be walked on."

BY THIS time the cleansing materials had been gathered by Dan's mother. We added a cupful of the scouring powder to a pail of hot water and used the solution for cleaning the door catches, knobs and chairs. The surfaces were sponged with water containing enough vinegar to make it taste a little sour. We dried everything with clean cloths so as to avoid any free moisture, which would have delayed us. Vinegar, I explained, was necessary to neutralize any alkali that might remain in the cracks or joints and possibly spoil the lacquer.

The woven (*Continued on page 103*)

An amazing Advancement!

The NEW "Aristocrat" Vernier Port Dial

SINCE the birth of radio, Kurz-Kasch has been foremost with all important improvements—the leader in the field of plastic mouldings. The name *Aristocrat* has always signified radio parts—dials, knobs, pointers, etc.—of unsurpassed quality and efficiency.

Our newest improvement—the latest addition to the noteworthy *Aristocrat* family is no exception! This Vernier-Port Dial is of Bakelite. It will improve the appearance and efficiency of any set a hundredfold.

The vernier ratio is 14 to 1. There are no gears, no cogs, no chains—*no backlash possible!* Nothing to wear out or get out of order. Easily installed—in a few minutes! The famous Kurz-Kasch split bushing fits any condenser shaft.

In three beautiful, attractive finishes—black, walnut or mahogany. If you are to build your own radio, be sure to select this *Aristocrat* Vernier-Port Dial if you want and expect best results.

If you already operate a radio with old-fashioned dials—or dials of doubtful quality and origin—replace them with this improved, modern Vernier-Port Dial. You'll be surprised at the difference in appearance and you will enjoy better reception due to more accurate tuning—bringing in countless stations you've never heard before.

You'll find the *Aristocrat* Vernier-Port Dial at all better dealers—$2 each—in the color and finish you select!

More than 200 manufacturers use and endorse Kurz-Kasch Products because of their uniform high quality, efficient design and precision. Kurz-Kasch mouldings bear this insignia—(K-K)—your guarantee of unequaled quality and unsurpassed craftsmanship. When you see the (K-K) trade mark of quality on any plastic moulding, you may be sure that quality has not been compromised in other important constructional details.

THE KURZ-KASCH COMPANY, *Moulders of Plastics*, Dayton, Ohio

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KURZ KASCH

Aristocrat Dials and Knobs

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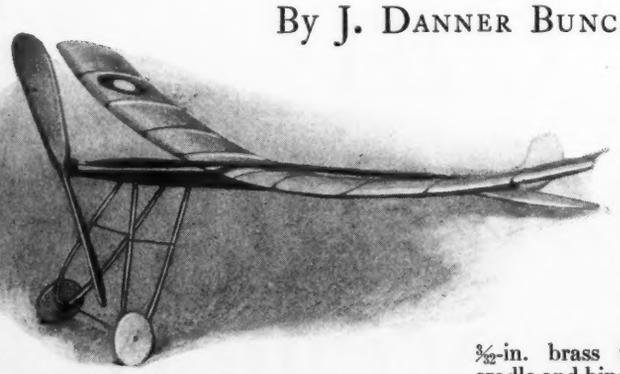
A Real "Rise-and-Fly" Model

Here's a Durable Little Plane That Gets Off the Ground Under Its Own Power

By J. Danner Bunch



The tractor airplane model before and during flight. Notice the curvature of the wing

YOU probably have flown model airplanes—most men and boys have—and, therefore, can answer this question: Which do you prefer to see, a tractor model in flight or a "pusher"?

Most model enthusiasts will say "tractor" at once, mainly because it is more nearly similar in construction to a full sized airplane. And a tractor, although usually cranky and hard to balance, is a very stable machine and makes consistently graceful flights when once a successful design, such as that illustrated, has been adopted.

In experiments with tractors, I came to the conclusion that the design should embody the following features: A high center of gravity, a medium dihedral angle, a large diameter, low pitch propeller, and a negative angle to the tail surface. These characteristics have been provided for in the model illustrated.

I call it an R. O. G. tractor monoplane because it will rise off the ground under its own power. It has made hand launched flights of 1500 ft. and R. O. G. flights of more than 1000 ft. Furthermore, it is a very durable machine. You should have equally good results if you follow the design closely.

Tool requirements are few. You will need a small pair of pliers, a knife, a block plane, and a small drill, as well as a candle and a pair of scissors.

MATERIALS are inexpensive—some good, straight grained white pine for wing spars and fuselage, a block of white pine for the propeller, some well dried bamboo for ribs and rudder, and some reed (rattan) for the undercarriage and tail. The reed should be ⅛ in. in diameter, and tough and springy. A small piece of 3/32 in. outside diameter brass tubing with 1/64 in. thick wall is needed for the propeller shaft bearing; some 1/32 in. diameter steel piano wire for propeller shaft, axle, rear hook and tail skid; a few ⅛-in. copper washers; a spool of white silk thread for binding; some china silk for covering wings and tail. The cheaper grade of china silk is better for this purpose, as it is not so closely woven and takes the "dope" better. To treat the covered surfaces and varnish the framework, you will need some regular airplane nitrate dope or some bamboo varnish, which can be purchased from any model airplane supply house, where you also can obtain the rubber needed for the motive power.

The first step is to construct the fuselage or body. Select two pieces of white pine 30 in. long for the longerons or side rails A. The longeron at its greatest depth, which is 5½ in. from the front end, is ⅜ in. From there it tapers to ¼ in. deep at the front end and to 3/16 in. deep at the rear. Plane to 3/32 in. thick, sandpaper and round the corners slightly. Measure back about ⅜ in. from the front end of each and make an angle cut so they will fit together closely. Put glue around the ends and bind the pieces together with a few wrappings of silk thread. Glue always should be used before binding.

The three cross braces or compression struts B are made from bamboo, 1/16 by 3/32 in. They are shaved thin at the ends, forced into knife slits in the longerons and glued. The front strut should hold the longerons 1⅛ in. apart, the middle strut, 1¼ in., and the rear strut, ⅜ in. Measure forward ¾ in. from the rear ends of the longerons, make angle cuts, and glue and bind the parts together, first sliding the longerons one way or the other until the fuselage is true. Trim the ends even.

Cut a block of white pine M, ⅛ in. thick and ¼ in. square, and groove slightly on top to make a cradle for the tubular propeller bearing. Lay the bearing L, which is 3/32-in. brass tubing 5/16 in. long, in the cradle and bind the whole. The front end of the tube should be tapped lightly with a hammer to form a lip so it will not slip back through the threads. Before the glue dries, line up the bearing fore and aft along the center line of the fuselage.

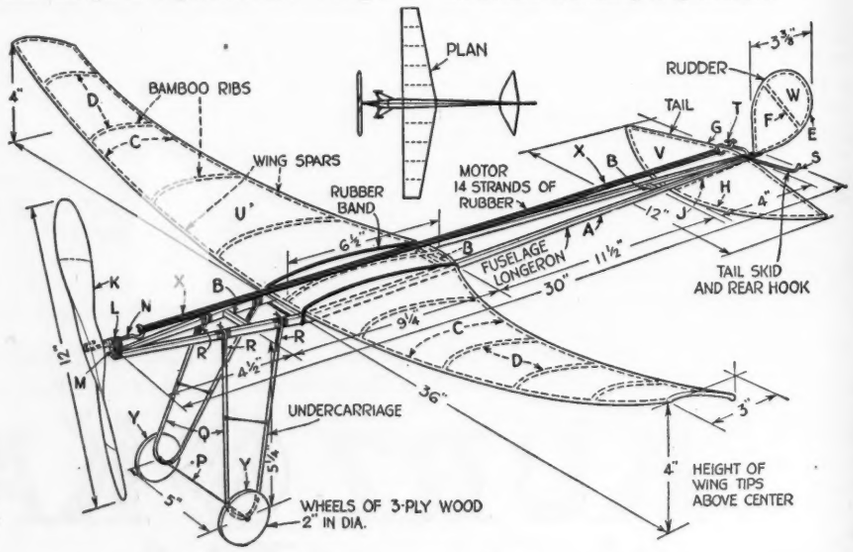
The rudder frame is of bamboo 1/16 by 3/32 in. The outline E is one piece 12 in. long. Drill a hole vertically through the end joint of the longerons, glue, and force one end of the outline into the hole until it comes through even with the under side. Next drill a hole into the end grain of the joint and force the other end of the outline into it.

Heat the bamboo a little, if necessary, to facilitate the bending. All bends in the bamboo should be made with the glossy side of the bamboo on the outside.

Make the rear hook and tail skid S, which is all one piece, out of 1/32 in. diameter piano wire; drill the necessary hole, put the wire in place, glue, and bind. The rudder brace F is bamboo 1/16 by 3/32 by about 3⅜ in. It is only necessary to force it in place as the covering will hold it securely.

Draw the un- (*Continued on page 94*)

Turn to page 76 for the continuation of the Home Workshop Department.



General view of the model. Complete details, full size wing plan, and bill of materials are contained in Home Workshop Blueprint No. 50, which can be obtained for 25 cents. See page 105 for list of blueprints

Inspectors and Care-Takers of RADIO

THESE Sterling DEVICES

Protect the Set-Owner Against Unnecessary Radio Troubles

DON'T expect your set to operate satisfactorily night after night without care or service.

Radio is the most delicate contrivance ever invented for public pleasure—and *must be given care!*

Batteries must be charged properly. Tubes must be tested frequently. The right voltage for your tubes—the correct rheostat setting for proper current supply are important. Transformer leaks and wiring faults must be remedied, weak tubes strengthened!

Any of these may mean the difference between poor and good reception.

And, all this can be done in the home by anyone with ease and no technical knowledge by using these handy Sterling Inspectors and Care-Takers.

See your dealer and select the equipment you need.

A suggestion to dealers—

SEE THAT YOUR SET-CUSTOMERS ARE ADEQUATELY EQUIPPED WITH STERLING RADIO PROTECTION

The set you sell must be satisfactory in service and naturally service depends on the proper service equipment. Be sure that your customers have the essential testing and care-taking Sterling equipment to protect their interest and yours.

Sterling RADIO CARE-TAKERS

$18
No. R-111 Bulb Type A & B Battery Charger

$15.00
No. R-900 Vibrating Type A & Auto Battery Charger

$14.00
No. R-101 Bulb Type Trickle Charger

$12.50
No. R-403 Tube Reactivator

$3.75
No. R-225 Midget Tube Reactivator

Sterling RADIO INSPECTORS

$1.00 to $4.00
Pocket Meter

$3.00 to $6.00
Panel Meter

$2.00
No. R-32 Charge Indicator

$7.50
No. R-411 Tube Tester

$18.00
No. R-406 Universal Tube Tester

THE STERLING MFG. COMPANY

CLEVELAND, OHIO

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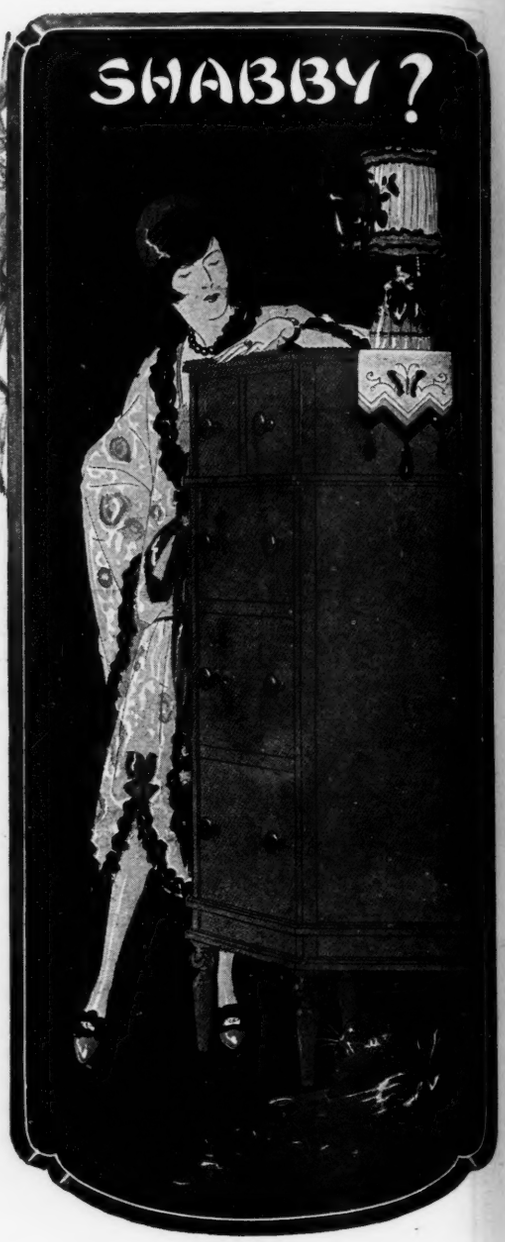
It's Fun ~ to use this Amazing New LACQUER



THINK of beautiful, lustrous *lacquer* colors—that you can apply to anything—*right over the old finish.* That dry hard and ready for use, *"while you wait"*—in thirty minutes or less. Do you wonder that thousands upon thousands are choosing this wonderful new *guaranteed* lacquer for home use?

There is no tedious preparatory work. There is no muss or litter or confusion. Merely wipe the object clean. Then apply Rogers Brushing Lacquer freely, with a brush. Sort of *flow* it on.

Even the "hands off" sign is a thing of the past, because: In thirty minutes a Rogers Brushing Lacquer job is dry as a bone AND READY FOR USE.

And the lustrous lacquer finish is of porcelain-like hardness. Covers completely. Wears and wears and *wears.* Does not print or gather lint. Does not pick up the under coat. Dries free of dust, without brush marks or laps—truly a most wonderful finish.

Rogers Brushing Lacquer can be used for literally hundreds of things in every home, from a desk lamp to a whole floor. Also in stores, offices, factory buildings, and in industries of all kinds.

Dealers everywhere sell Rogers Brushing Lacquer. Comes ready for use, in eighteen exclusive lacquer colors, from which endless tints and shades can be made. Also black, white and clear.

But be sure you get the genuine "Rogers" in the Oriental can—the kind sold on a *"Money-Back" Guaranty.*

DETROIT WHITE LEAD WORKS, *Detroit, Michigan*
Makers of Highest Grade Paints, Varnishes, Colors, Lacquers

ROGERS
THE MARK OF QUALITY

BRUSHING LACQUER

"MONEY-BACK" GUARANTY

Try one can of Rogers Brushing Lacquer. If not more than satisfied, return what is left to your dealer. He is authorized to refund the entire purchase price

Also distributed and guaranteed by

ACME WHITE LEAD AND COLOR WORKS
Detroit, Michigan

LINCOLN PAINT AND COLOR COMPANY
Lincoln, Nebraska

THE MARTIN-SENOUR COMPANY
Chicago, Illinois

PENINSULAR PAINT AND VARNISH COMPANY
Detroit, Michigan

THE SHERWIN-WILLIAMS COMPANY
Cleveland, Ohio

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

Comes in 18 charming, glossy *lacquer* colors from which an endless variety of beautiful intermediate shades can be made. Also white, flat white, black and clear. The "clear" is used like varnish.

27-A

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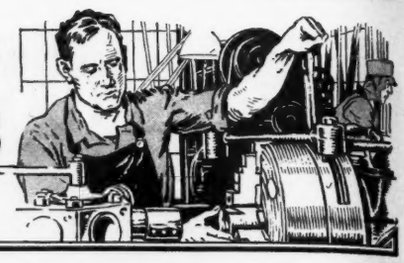
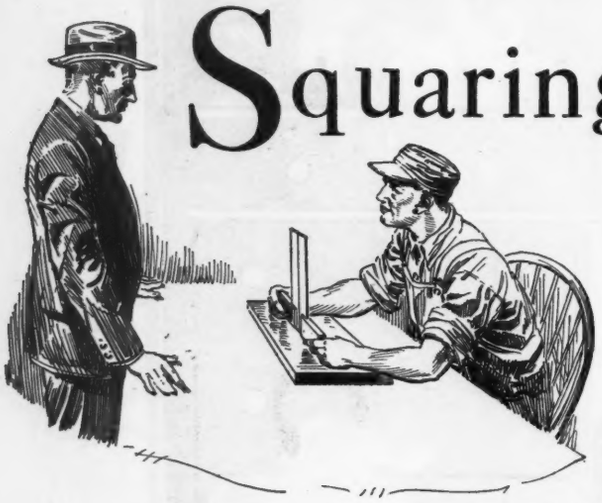
Better Shop Methods

How Expert Mechanics Save Time and Labor





Squaring *Your* Squares

How to Test Them Accurately—The Astonishing Futility of Many Common "Proofs"

By Henry Simon

IS YOUR try-square square? When is it square? How do you know it is, and how can you prove it?

The mechanic who was asked these questions opened a drawer and took out two shiny squares.

"See those? Well, I'll show you!" And he performed six tests (Fig. 1, Nos. 1 to 6), using for the last two a steel plate with ground and polished surface and edges. The two squares matched beautifully every time.

"How's that? Beginning to look pretty good?"

We thought it was more than pretty good—in fact, more than enough. But he went on and put the squares through their paces again. Two more tests! Eight tests in all! The one before the last was the reversing test. We knew that one, and two or three of the others. But we had never thought of all of them. Didn't think, to tell the truth, that a square could be tried so many ways.

Satisfied? I guess we were. If those eight tests didn't prove the square square, then what would? We were more than satisfied, and we told the mechanic so.

AND with those eight impressive tests, our mechanic had not proved either one of those squares. With the first six, in fact, he had not proven anything—he had not shown one single element of either square to be right or wrong. With the seventh test, he had managed to show both squares to be 25 percent right; but they might still be 75 percent wrong. The eighth test did not better that percentage, but merely corroborated what previous ones had established. So, at the end of the eighth test, for all the proof, both squares might still have handle and blade both out of parallel, with three angles wrong on each.

Seems impossible? Perhaps so, but take a look at Fig. 2, Nos. 1 to 8 inclusive.

Note that in Nos. 1, 2, 3, 4, 5 and 6 the same squares, each out of true in every conceivable way, were used, and that in spite of this they match perfectly in every position shown. See how the seventh test succeeded only in establishing one right angle on each—the angle between the inner edge of the handle and the outer edge of the blade. Look at the eighth test, and prove to yourself that it did not help matters any—handle and blade are still out of parallel, and all but one angle wrong—the angle shown to be 90 deg. by No. 7.

It might here be objected by the argumentative mind that the chances are against both squares being out of true just the way they are shown, and that the law of probability is in favor of the squares proving each other after the first two or three tests. There is some truth in that argument, but its force is spoiled through practical considerations. One of these is that if two squares each have only two compensating defects, such as for instance the pair shown in Fig. 3, No. 6, where each has one right angle, while being out of parallel on the handle and the blade, they can still pass seven tests without being proven true.

This narrows (*Continued on page 125*)

MANY time-saving shop ideas are contained in the continuation of the Better Shop Methods Department, on pages 114 to 117 and 125 to 131.

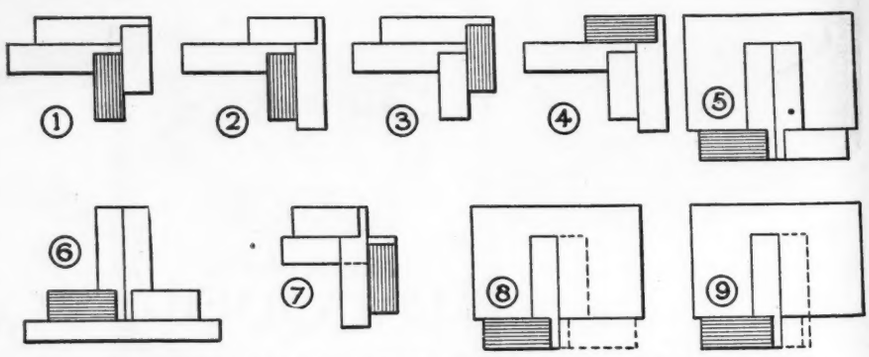


Fig. 1. Any two or three of these tests ordinarily would be regarded as proof that the squares are really square and absolutely accurate, yet without the ninth test the others are quite valueless

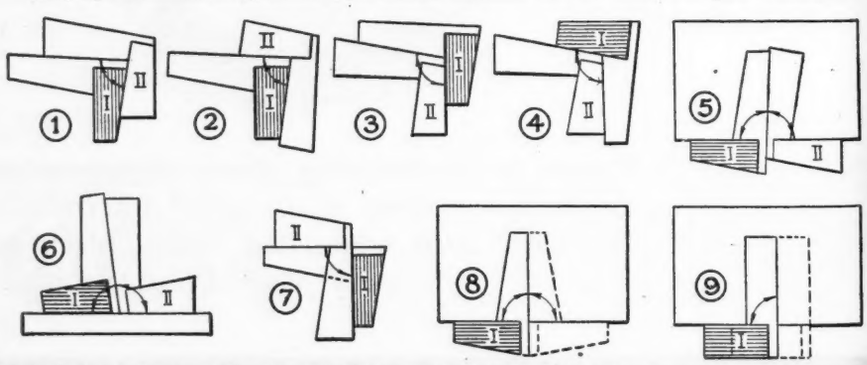


Fig. 2. Here is a very interesting and amusing proof of the pitfalls in testing two squares of unknown accuracy. Note that the pair of squares used in tests 1 to 6 are out of true in every way

S'matter, Pop?

Starrett Combination Square No. 94 — the tool with more uses than a dog has fleas.

'S funny, once you've formed the habit of working with a Starrett Combination Square, you're absolutely lost when somebody gets away with it.

That's because of its great convenience, the number of different tools it replaces and the tremendous number of uses it can be put to.

When you stop to think that 7 distinct tools are replaced by the No. 94 — a marking gage, a rule, a square, a miter, a depth gage, a height gage, and a level and plumb — it's easy to see what a hole its loss leaves in most men's kits.

And when you start to figure up the number of *uses* for this one tool — well, as one practical carpenter put it, "Every day and every job brings a wholly new use for this Combination Square."

Ask your hardware dealer to show you one — and also write us for a free copy of Catalog No. 23 "W."

THE L. S. STARRETT CO.
. World's Greatest Toolmakers
Manufacturers of Hacksaws Unexcelled
Steel Tapes—Standard for Accuracy
ATHOL, MASS.

NATIONAL STEEL & MACHINE TOOL EXPOSITION CHICAGO 309

9307

Use Starrett Tools

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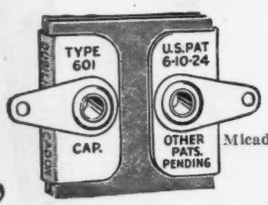
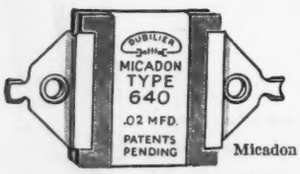
every one a micadon

There are now three types of Micadons—each made to meet a new development in radio.



Micadon 601

Micadon *601* is the standard of small fixed condensers. Designed on revolutionary principles, it was one of the first radio products to discard heavy molded insulation with its high dielectric losses. It provides and maintains a constant, fixed capacity wherever small condensers are required.



Micadon 640

In Micadon *640*, the need for higher capacities in super-heterodyne, reflex and resistance-coupled amplifiers has been met. The same accuracy, the same principles of insulation and protection against losses in its fixed and permanent capacity have given this condenser its unequalled popular demand.

Micadon 700

Micadon *700* is the newest addition to this famous line. Completely shielded in its bright aluminum case, it is designed to withstand even the voltage found in low-power C. W. vacuum tube transmitters; thus providing the most compact, efficient and economical unit of fixed capacity that radio has yet known.

Three different types—but *every one a Micadon*. In the patented principles of their design; in the scrupulous care given to every stage of their manufacture; in their delicate precision, fully shielded and protected—worthy to bear the name of radio's greatest maker of condensers.

Dubilier
CONDENSER AND RADIO CORPORATION
4377 Bronx Blvd., New York, N. Y

The Home Workshop

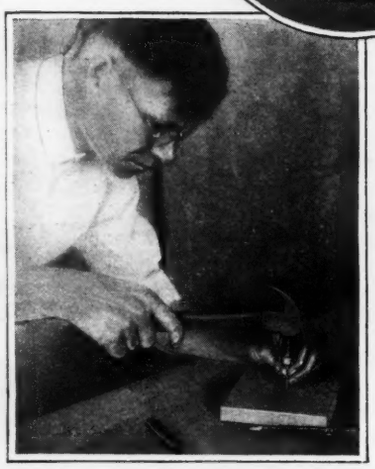
Practical Pointers *on the Use of* Auger Bits

By Emanuel E. Ericson
Noted Manual Training Authority

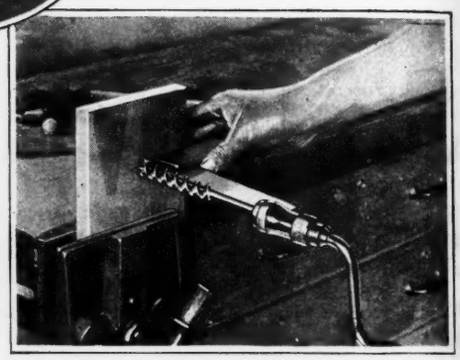
1 The bit number marked on the shank is the size in sixteenths of an inch

2 To put an auger bit in the brace, open the jaws wide, insert the square shank so that its corners are in the grooves of the chuck and tighten

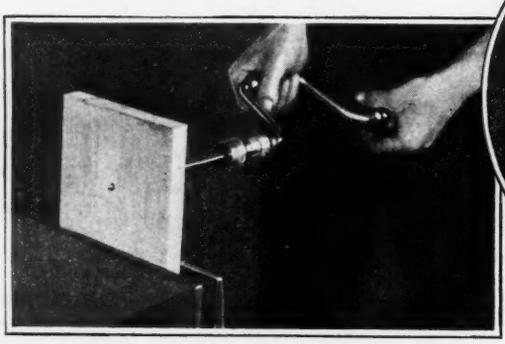
3 (Right) Use a rule, try-square and marking gage or other means to mark the center of the hole to be bored



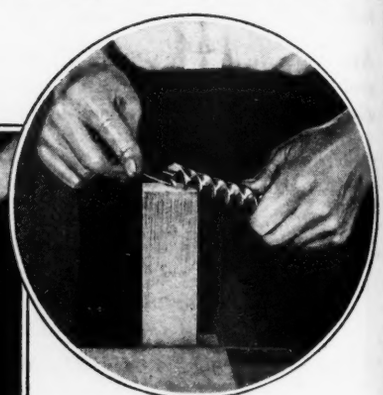
4 Whenever accurate work is demanded, the center should be pricked with a sharp nail, punch or other pointed tool so that the bit will not slip



5 To insure boring straight, use a try-square to test the direction, both vertically and horizontally. Dowel holes often are guided by means of a doweling jig, which is clamped directly on the work



6 When the spur of the bit comes through, stop boring, remove the bit, reverse the brace, and bore from the other side until the hole is finished. This will insure clean edges. In removing a bit, give it one turn backward to loosen the screw point, then pull it out while turning steadily forward. This will insure bringing out the shavings



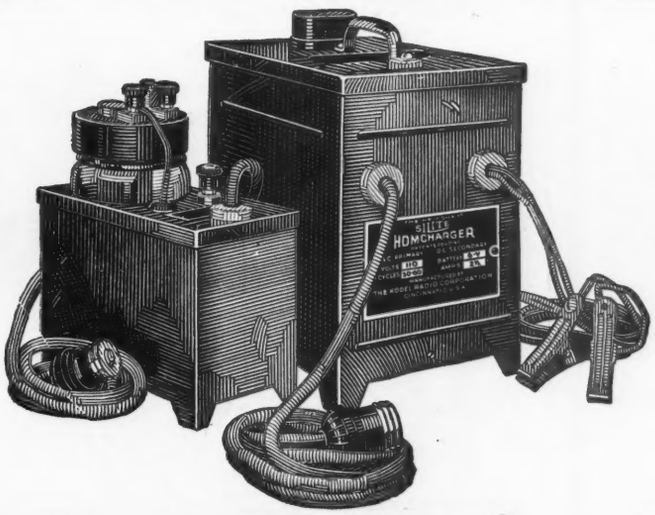
7 If a bit strikes a nail or becomes dull through use, it can be restored by filing it with a special auger bit file. Sharpen only the inside of the "spurs" and the upper (shank) side of the cutters or "lips." Consult a tool catalogue for the various types of plain and expansive bits

SILITE
TRICKLE CHARGER

SILITE TRICKLE CHARGER. Absolutely silent charging. May be left permanently on charge.

Complete

$10.00



SILITE HOMCHARGER. Absolutely silent. Gives healthy 2½-3 ampere rate.

Complete

$19.50

Absolutely Noiseless
Makes a power unit of your storage battery!

You can make a power unit of your present storage battery with the new Silite Trickle Charger. Absolutely noiseless, without bulbs or moving parts, Silite Trickle Charger is left permanently on charge. It replaces at a slow rate the power you use while your set is operating.

No Bulbs—No Adjustments—Nothing to Wear Out

Silite is the marvelous new metallic glass rectifying element discovered and perfected in the Kodel laboratories. Silite Chargers have no adjustments, no wearing parts—they cannot overheat or damage your battery. Silite Trickle charges at .6 ampere—much faster than other trickle chargers—enough to keep a battery always at top efficiency.

Can Be Used While Set is Operating

Silite Trickle Charger creates absolutely no hum or noise, no interference. So silent it may even be used while you operate your set. When you equip your battery with the Silite Trickle Charger just forget about charging altogether. Silite Trickle requires no attention except the periodical addition of a little water.

Ask your nearest radio dealer about Silite. Have him show you both the Trickle and the larger model.

"Behind the Scenes in a Broadcasting Station", an interesting, 24-page booklet, together with literature describing Silite Battery Chargers, will be mailed free on request.

DEALERS: Write for full particulars of Silite and other Kodel products.

THE KODEL RADIO CORPORATION • 500-521 E. Pearl St. • CINCINNATI, OHIO

Owners and Operators of Broadcasting Station WKRC

Battery Chargers Power Units

KODEL

Radio Receivers Loud Speakers

POWER SPECIALISTS SINCE 1912

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS, See page 6.

"ATKINS"
Try This Saw—
And it will be your favorite saw always. ATKINS "No. 400" is the aristocrat of all the ATKINS line—the finest saw that bears this world-famous name on the blade.
Only ATKINS Saws are made of "Silver Steel" to hold their edge through added years of satisfactory sawing service. "Taper Grinding" makes ATKINS Saws cut faster and easier.
There's an ATKINS Saw to save you time, labor, material and money no matter what material you saw. Ask for our FREE folder—"Atkins Saws in the Home." (IS)
E. C. ATKINS & CO.
Established 1857
Leading Manufacturers of Highest Grade Saws for Every Use; Saw Tools, Saw Specialties, Plastering Trowels, and Machine Knives
INDIANAPOLIS, U. S. A.
ATKINS SILVER STEEL SAWS

The Home Workshop

Ship Model Fans, Ahoy!

You Can Build a Rotor Yacht

Hints on Using Flettner's Marvelous Ideas in a Miniature Boat

By Ernest Welleck

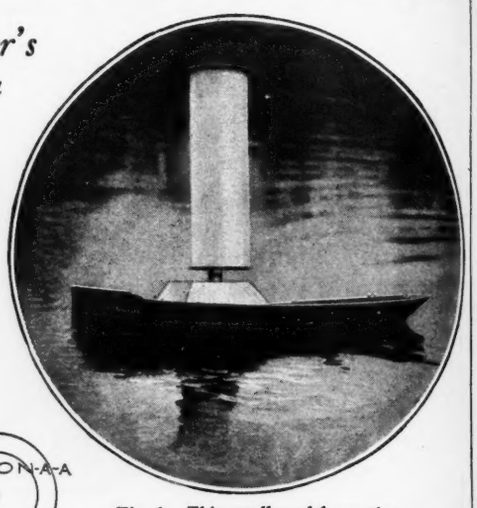


Fig. 1. This small model was the first rotor ship built by Flettner

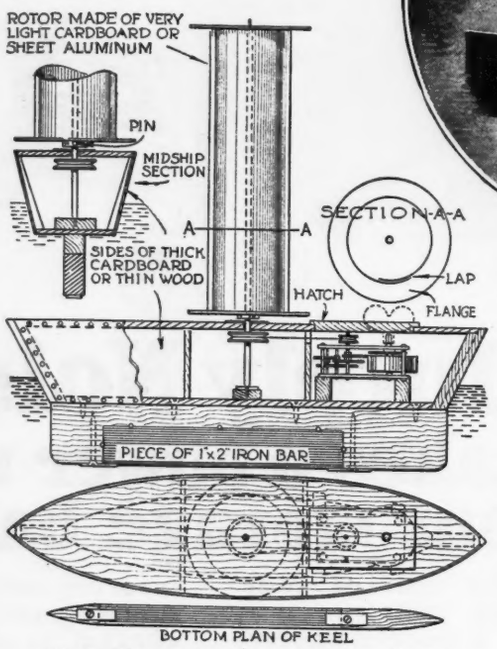


Fig. 2. Diagram suggesting one of the simplest ways to construct a clockwork-driven rotor ship

JUDGING from the interest that so many readers of the Home Workshop family have taken in the building of ship models, it is reasonable to assume that they will be doubly interested in building on a small scale a working model of a rotor ship, Anton Flettner's sensational invention.

Although the rotor and its application for propelling ships and windmills, as described last month in Popular Science Monthly, are protected by patents in all civilized countries, those who make miniature rotors need not fear suit for infringement. The inventor, during his recent visit to New York, cheerfully extended his permission for Home Workshoppers to build such models. At the same time he expressed the confident belief that the building of small rotor ship models not only will give the builders pleasure, but also will teach them intensely interesting lessons in aerodynamics.

Before Mr. Flettner built his first rotor ship, the *Buckau*, now *Baden-Baden*, he prepared the ground by several months of experiments with models (Figs. 1 and 3). He established by tests that the potential propelling power of a rotor cylinder of a given projection surface is equal to that of a sail or sails with an area ten times as great. The theory of this was explained last month and is again indicated diagrammatically in Fig. 4.

As rotors may be used on any ship, practically any hull design may be chosen for a rotor ship model. Those among the workshoppers who have had experience in building sailing models will find no difficulty in making a suitable hull. Those who have had no such experience will find in Home Workshop Blueprint No. 48 (see page 105) an excellent yet simple way of building a small hull of a racing type.

Anyone who has built several ship models and wishes to change one of them into a rotor ship may do this easily by removing the masts and sails and putting in their place one or two rotor cylinders.

The rotor cylinders may be made of stiff paper, cardboard or thin sheet metal. The dimensions for a hull 2 ft. long are given in Fig. 5. If the hull is made larger or smaller, the rotor dimensions should be changed proportionately.

A ROTOR cylinder should be closed at each end by a flat disk, about 1 in. larger in diameter than the cylinder, so that it forms a flange approximately ½ in. wide at top and bottom. These flanges increase the effectiveness of the rotor by 100 percent, as they prevent the air from flowing in at both ends and destroying the suction effect, which supplies seven eighths of the propelling power of the rotor.

The rotor or rotors always should be in a vertical position when the ship is on an even keel.

In a model built for looks only, the placing of the rotor or rotors is a simple matter. Each (*Continued on page 80*)

(IS) This seal on a radio or tool advertisement signifies the approval of the Institute of Standards. See page 6.

A-B & C Radio Power
from your light socket

Kodel A&B Transifiers

Now all radio power is in your light socket. Kodel A and B Transifiers replace all batteries—supply "A", "B", and "C" power direct from your lighting circuit. No changes in the set are necessary. Just plug the Transifiers into the wall socket and turn on your receiver. Gives new life, new pep, new range to any set—transifiers will bring you an altogether new idea of really fine reception.

Kodel A and B Transifiers are vastly different from and superior to so-called "power units". Transifiers do not consume current except while your set is operating—costs much less for maintenance—less than one-half cent for every hour you operate the set.

Modernize your present radio—do away forever with those messy batteries—equip your set with Kodel Transifiers either "A" or "B", or both. They operate independently of one another—your nearest radio dealer can supply you with any of the three models.

KODEL "A" TRANSIFIER
Model 10

Furnishes 2, 4, or 6-volt "A" power for sets using up to eight 201-A tubes or equivalent—constant uniform current that operates tubes at maximum efficiency. Consumes current only while set is operated. Automatic relay switch turns off Transifier when you turn off the set. Price without bulb

$42.50

KODEL "B" TRANSIFIER
Model 61

Specially designed to furnish full "B" power for sets using up to six 201-A tubes or equivalent. Supplies 24 to 45 volts for detector, 90 to 100 volts for amplifying tubes. Voltage can be varied to suit receiver. Can be used separately or with "A" Transifier. Price without bulb

$28.50

KODEL "B" TRANSIFIER
Model 10

Supplies constant uniform "B" and "C" power for any size set. 22½ to 45 volts for detector; 67½ volts intermediate amplifier; 90 volts amplifier; 135-150 volts for power tubes. Also furnishes 4 to 10 volts "C" power. Can be used separately or with "A" Transifier. Price without bulb

$42.50

"Behind the Scenes in a Broadcasting Station", an interesting 24-page booklet, together with literature describing Kodel A and B Transifiers, will be mailed free on request.

DEALERS: Write for particulars and discounts on Kodel Transifiers.

THE KODEL RADIO CORPORATION • 500-521 E. Pearl St. • CINCINNATI, OHIO, U. S. A.

Owners and Operators of Broadcasting Station WKRC

Battery Chargers Power Units **KODEL** *Radio Receivers Loud Speakers*

POWER SPECIALISTS SINCE 1912

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS, See page 6.

Time Tried and Tested

STAR HACK SAW BLADES

To buy a hack saw blade that has been used and tested the world over for the last half century is buying a certainty.

To buy a blade that you understand is just as good is buying an uncertainty.

Tell us of your cutting requirements and let us send you sample blades that will do the work.

WRITE FOR FREE SAMPLE BLADES

Clemson Bros., Inc.
Middletown, N. Y.

MAKERS SINCE 1883

STAR HACK SAWS

TRADE MARK

The Home Workshop

You Can Build a Rotor Yacht

(*Continued from page 78*)

cylinder is provided with a spindle which passes through the centers of the two end plates. The lower end of the spindle is inserted in a hole in the deck of the ship or in a small cylindrical base, slightly larger in diameter than the cylinder of the rotor and about ½ in. high.

When a working model is attempted, some means for turning the rotor or rotors at a rate of 100 to 150 revolutions a minute must be provided. If one is content to "sail" the model only in one direction in relation to the wind, that is, with the wind either port or starboard, it is sufficient to have the rotation in one direction. To allow the boat to be "sailed" back and forth across a pond, the mechanism must allow the direction of rotation to be reversed.

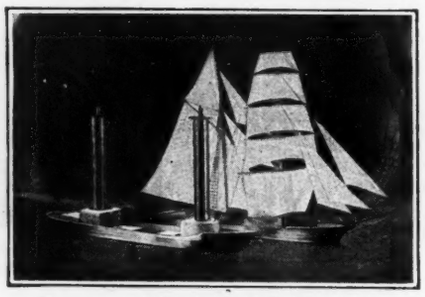


Fig. 3. In laboratory wind tunnel tests these models proved of equal efficiency

The selection for the source of power for the rotor must be left to the ingenuity of the builder of the model. The most primitive and cheapest, but not the most satisfactory power plant, is undoubtedly a rubber-band motor similar to that used to rotate the propellers of small airplane models.

One type consists of a rod about 1 ft. long, with a fixed disk at one end and a rotatable disk at the other. Through holes near the periphery of each disk rubber bands are threaded from one disk to the other. At one end the rod is provided with a crank handle and a ratchet wheel. When the crank is turned, the rubber bands are twisted around the rod, which is held in place by the ratchet when the required tension has been reached. The tension of the twisted rubber bands would cause the rotatable disk at the other end of the rod to revolve as the crank is set in motion, were it not for the fact that it is held by a trigger. When the trigger is released, the wheel begins to turn and, as it is geared to a small cogwheel on the propeller shaft, it imparts to the propeller a rapid whirling motion. A similar contrivance may be stowed away in the hold of the ship model and geared to the shaft of the rotor to give the required speed. The rubber bands can be purchased from any model airplane dealer and the gears obtained from a toy construction set.

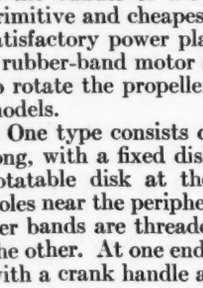


Fig. 4. How wind, rotor and boat move

The spring actuated mechanism of an old alarm clock, a similar mechanism taken from a defunct mechanical locomotive or other toy may be used to better advantage for operating the rotor.

MANY toy spring motors and music box motors have speed governors, which keep the speed of rotation more or less uniform. This is of especial advantage in a rotor ship model.

With some ingenuity a gear shift may be interposed between the drivewheel or shaft of the source of power and the spindle of the rotor, so that the rotor cylinder may be rotated in either direction.

Anyone who possesses a small electric motor driven by a miniature battery may consider himself particularly fortunate, because, with this power plant in the hold of the model and geared to the rotor spindle, his ship will be able to undertake much longer cruises.

These suggestions, which by no means exhaust the possible means for supplying the required motive power, make it obvious that it would be impractical to give definite directions for installing all of these "motors" or for hooking them up with the rotor. These problems, different in each individual case, must be solved by the workshopper who undertakes to build a working model of a rotor ship.

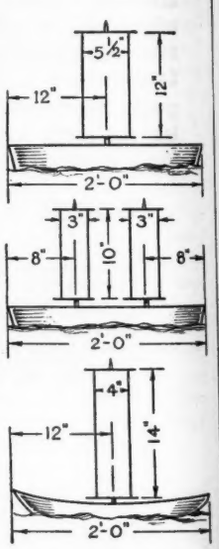


Fig. 5. Two freight and one racing model

If the works of an alarm clock, a mechanical toy or a music box are selected, they should be placed as low as possible in the hold of the ship, so that they will act as ballast and add to the stability of the ship. In placing the works, it must be remembered that they must be wound from time to time. Do not locate them so that it will become necessary to take the entire ship model to pieces to wind up the spring. There again you will have to exert your ingenuity.

Another prob- (*Continued on page 81*)

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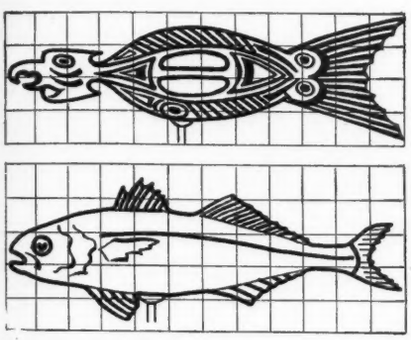
The Home Workshop

Ornamental Weather Vanes for the Camp Cabin

WEATHER vanes for the camp may be cut from ½- or ⅝-in. cedar, cypress or pine boards and mounted on brass rods. The designs below can be enlarged easily by means of the squares to any size. The originals were 2 ft. long.



A conventionalized bird to be painted gayly, and a bluefish. Each square represents 2 in.

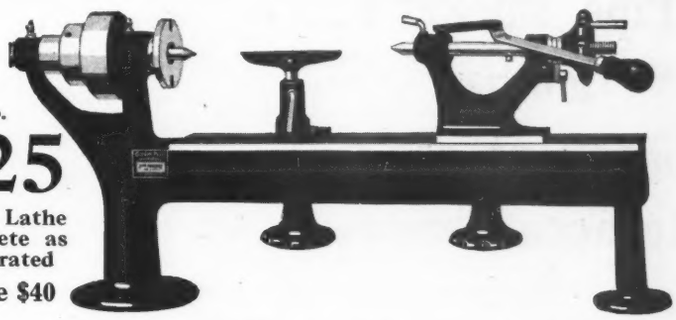
You Can Build a Rotor Yacht

(*Continued from page 80*)

lem is presented by the hooking of the driving mechanism with the rotor to give the proper speed. The simplest scheme is illustrated in Fig. 2. In a fair wind the rotor should make about 100 revolutions a minute; in a gentle breeze, about 150.

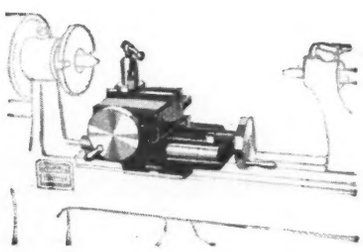
On the *Baden-Baden* the rotors are driven by individual electric motors, the speed of which can be regulated and controlled from the bridge. The best that can be done in a rotor ship model is to provide for a maximum speed of 150 revolutions a minute and devise some means—two pulleys of different sizes, for example, on either the rotor or the driving shaft—for reducing the speed of the rotor if the wind is stronger.

Without a gear shift to make it possible to turn the rotor cylinder either clockwise or counter-clockwise, the ship model can sail only in wind coming from one direction. If you imagine the rotor turning clockwise, for example, your ship can sail only when the wind comes from the left side, facing the bow. Wind coming from the right would drive the ship backward.

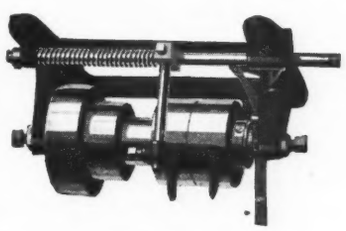


No. 125 Bench Lathe Complete as Illustrated Price $40

This bench lathe makes your home shop a real workshop



No. 132 Slide Rest Price $17.50



No. 130 Counter Shaft Price $12

THERE are many turning and boring jobs you could do yourself if you had a bench lathe. Make your workshop more complete by adding to it this Goodell-Pratt Lathe. It enables you to do professional-looking work. Over-all length of this bench lathe is 25 inches; height, 11½ inches; swing, 7 inches; extreme distance between centers, 12 inches. It weighs only 30 pounds.

This lathe has a milled bed and a tail stock with milled base. Live spindle has a cone bearing to take up wear. The tail stock has both screw and lever feed. Cone pulley has 3 steps—1½, 2½, 3½ inches in diameter. The lathe is finished with black and red enamel. All working parts are beautifully polished.

A complete line of attachments is available to fit this lathe. Among them are a slide rest, lathe tools, compression check and collets, milling attachments, turret attachments.

Bench Lathe No. 494

This lathe has the same construction as the No. 125 above, but is slightly larger. Length over all, 31 inches; height, 11½ inches; swing, 7 inches; extreme distance between centers, 18 inches. Net weight, 36 pounds, price $44.

400-page Book of Tools FREE

A postcard will bring you the 400-page pocket-size book of all the famous 1500 Goodell-Pratt tools. In this book are shown and described many tools you will want to outfit your workshops completely. Every tool shown is beautifully made and finished by skilled toolmakers. Just let us know where to send your copy of the book. It is FREE.

GOODELL-PRATT COMPANY
GREENFIELD, MASS., U. S. A. Ⓢ

Makers of Mr. Punch

GOODELL-PRATT
1500 GOOD TOOLS

Pipe smoker's mother happy at son's tobacco choice

There is plenty of evidence to prove that the ladies are not averse to pipe smokers. Provided, of course, that the man in the case chooses the right tobacco.

The following letter from Mrs. Higgins of St. Louis reflects the pride and satisfaction of a mother who feels that her son has made a wise decision.

Read her letter—then show it to your wife:

Larus & Bro. Co., Richmond, Va.
Gentlemen:

Can a mere woman praise Edgeworth? When my sixteen-year-old son started to smoke, it was a pipe. I guess he tried all the brands of tobacco on the market, trying to find a mild, cool smoke. He gave up smoking in disgust, saying he guessed he never would be a man if it depended on smoking a pipe. At last an old timer told him to try a pipeful of his Edgeworth. Now my son is never in too big a hurry to walk several blocks out of his way to get it.

I sometimes wish every day was Sunday so he could be home smoking, for the aroma of Edgeworth is delicious.

Yours very truly,
Mrs. A. Higgins.

To those who have never tried Edgeworth, we make this offer:

Let us send you free samples of Edgeworth so that you may put it to the pipe test. If you like the samples, you'll like Edgeworth wherever and whenever you buy it, for it never changes in quality.

Write your name and address to Larus & Brother Company, 10-U S. 21st Street, Richmond, Va.

We'll be grateful for the name and address of your tobacco dealer, too, if you care to add them.

Edgeworth is sold in various sizes to suit the needs and means of all purchasers. Both Edgeworth Plug Slice and Edgeworth Ready-Rubbed are packed in small, pocket-size packages, in handsome humidors holding a pound, and also in several handy in-between sizes.

To Retail Tobacco Merchants: If your jobber cannot supply you with Edgeworth, Larus & Brother Company will gladly send you prepaid by parcel post a one- or two-dozen carton of any size of Edgeworth Plug Slice or Edgeworth Ready-Rubbed for the same price you would pay the jobber.

On your radio—tune in on WRVA, Richmond, Va.—the Edgeworth station. Wave length 256 meters.

The Home Workshop

He's a Wise Old Walnut Bird

And All He's Made of Are Two Nuts and Some Scraps—A Novel Dinner Party Favor

By F. Clarke Hughes

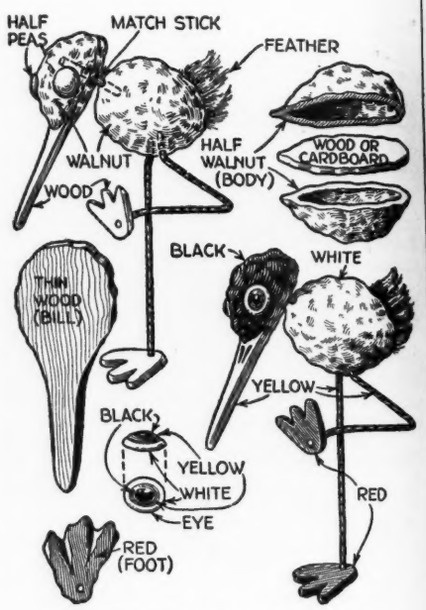
THIS wise old bird may be made quickly and easily from three half-sections of English walnut shells and some other small accessories.

First make the body by gluing two half-shells together with a piece of thin wood or cardboard between them. The wood or cardboard offers less resistance than the shell when the holes for the legs and neck are drilled.

The head and long beak are made as shown. The eyes may be half-sections of dried peas or cherry pits glued in place; the feet, cardboard, heavy rubber or linoleum. A match or toothpick makes a good neck, but should not be glued. Feathers are glued on to represent the tail. Light magnet or bell wire, with the insulation left on, serves well for making the legs, which then may be bent into all sorts of amusing positions.

For holding the various parts in place, use glue, sealing wax, or beeswax.

The bird finally should be painted in bright, clear oil colors or, if quick drying is desired, with dry powdered colors mixed with white shellac.



The body of the bird is made like the head by gluing shells to thin wood or cardboard

Can You Think of a Good Name for These Novelties?

MR. HUGHES' walnut bird has many relatives. They are all made of odds and ends—nuts, pine cones, beads, matches, toothpicks and bits of wood, glass, tin foil, and the like.

These curious little novelties, which are lots of fun to make and exceedingly amusing to look at, will be described in a series of short articles. We should like to give a catchy name to these things. "Scrappies" has been suggested, since they are made of scraps of material picked up here and there—nut scrappies, cone scrappies, shell scrappies, and the like. Another proposal is "bit-lucks."

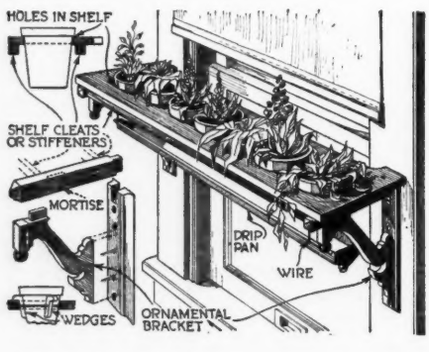
Perhaps you can think of something better. If so send in your suggestion before September 30. For the most appropriate name, POPULAR SCIENCE MONTHLY *will pay $5.*

A High Window Shelf for Flowerpots

ROMPING children are so apt to upset flowerpots when placed on ordinary window ledges, window shelves or plant stands, that it is worth while to make high flower shelves of the type illustrated. They keep the plants out of harm's way and at the same time give a novel and distinctive window treatment.

The shelf is a ⅞-in. board about 2 in. wider than the diameter of the top of the flowerpots. The side next the window is cut out so that the shade can be pulled down.

The shelf bracket can either be bought or made from wood according to any suitable design. A neat tin drip pan is suspended beneath the pots. If pots smaller than the holes have to be accommodated at any time, it is a simple matter to fasten them with wedges, as shown. The shelf should either be stained and varnished, or painted or enameled to match the woodwork of the window trim.—GEORGE H. CAPPEL.



The shelf is placed far enough up to keep the plants well out of the way of romping children

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Know the Truth *about* OIL HEAT

NO more mystery—no more half truths—no more technical and engineering "patter" which few homeowners understand!

This new book sweeps aside all these, and deals with oil heat as you would like to know it in your home, and nothing else. It digs out the truths about cost of operation, supply of oil, cleanliness, dependability, and gives them to you so simply that all who read will quickly gain new understanding of oil heat.

Heating Homes With Oil is not intended for the idle curious—but rather for those who are sick and tired of vexatious, uneven temperature, who really want the comforts only oil heat can bring.

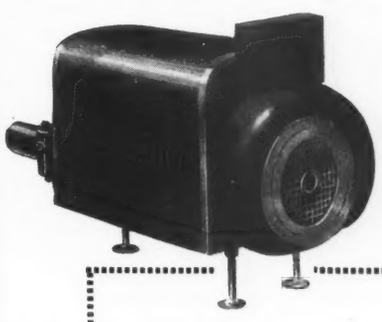
No family that has experienced the dire effects of coal strikes, temperamental coal fires, or low gas pressure should go another day without knowing what oil heat means to health, to freedom from care, to solid comfort. You owe it to yourself and family to at least consider these facts. Just send the coupon shown below and the next mail will bring it to you. No cost—no obligation at all!

The authorized dealer for Oil-O-Matic in your city offers you the services of graduates of the Williams Institute of Heat Research, the world's largest school on oil burning. Let them examine your heating plant and give you the complete cost of a guaranteed installation. Every day you delay is a happy day of comfort lost.

THIS BOOK *is* FREE

Simply clip and mail the coupon below now and you will never go thru another season without the comfort of oil heat.

Because Oil-O-Matic burns cheap fuel oil according to the four natural laws of oil combustion with no part inside the firebox – it renders a service that makes it the world's biggest selling oil burner.



Williams Oil-O-Matic Htg. Corp.
Bloomington, Ill.

Please send me free and postpaid a copy of your latest booklet, "Heating Homes With Oil" with plan for ideal basement.

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P.S.96

WILLIAMS OIL-O-MATIC HEATING

World's largest producer of automatic oil burners

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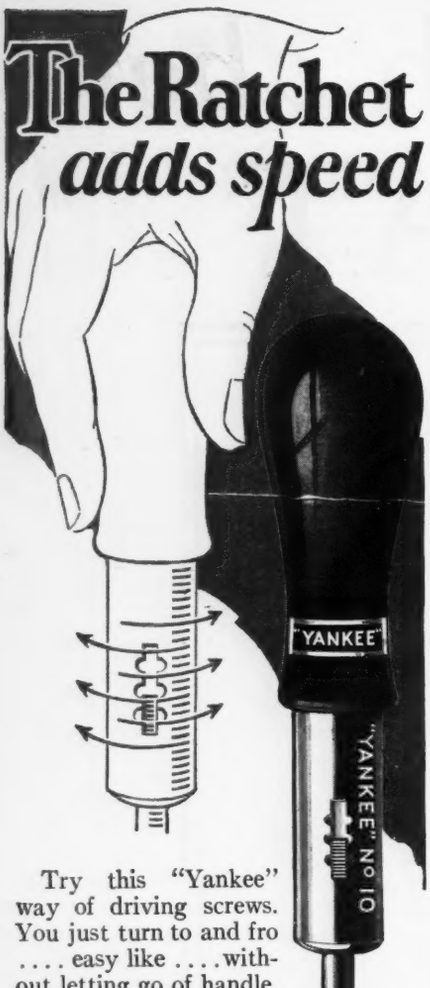
The Ratchet adds speed



Try this "Yankee" way of driving screws. You just turn to and fro .... easy like ....without letting go of handle. A slick ratchet movement drives screw home. Right and Left Ratchet, and Rigid. Saves time and strength.

Ask dealer for the "Yankee" Ratchet Screw-driver.

No. 10 With ratchet shifter moving lengthwise with tool. Eight sizes: 2- to 12-inch blades.

No. 11 Same as No. 10, except shifter moves across tool.

No. 15 With "Yankee" Thumb-turn on blade for starting wobbly screws with thumb and forefinger. Six blade lengths, 2- to 8-inch. All blades, $\frac{3}{16}$ diameter.

Write for "Yankee" Tool Book.

Shows just how "Yankee" Tools make work easier, Ratchet Bit Braces, Ratchet Breast: Hand, Chain and Bench Drills. Automatic Push Drills. Spiral Screw-drivers. Ratchet Tap-wrenches. Vises-removable base. Etc.

"Yankee" on the tool you buy means utmost in quality, efficiency and durability.

NORTH BROS. MFG. CO., Philadelphia, U. S. A.

"YANKEE" TOOLS

Make Better Mechanics

The Home Workshop

How to Take Advantage of the Vogue for Shutters

WITH many houses, the addition of window shutters goes a long way toward lifting the design from mediocrity to distinction. The present vogue includes a wide variety of shutters ranging from roughly dressed slabs to the more elaborate Venetian blind type.

For windows of average size, use 1 by 3 in. stock for the stiles (upright members) and upper rails of the Venetian blind type of shutter (Figs. 2 and 3), and 1 by 4 in. for the lower rails. Cut the stiles 2 in. longer than the shutter lengths, and the rails 1 in. shorter than the shutter widths. Lay out for mortises in the stiles and tenons on the rails, guiding the gage lines always from face edges and sides.

For receiving the ends of the slats, cut ¼-in. dados across the inside edge of the stiles at angles of 45 degrees, to a depth of ⅜ in. The upper edge of one slat should be a little higher than the lower edge of the next slat above.

Assemble rails and stiles, using heavy white lead instead of glue. Afterward bore through the mortises and tenons for two ⅜-in. dowels.

Use ¼ by 1½ in. stock for the slats, cut to lengths that may be driven in tightly after being coated with white lead. Fasten with 1-in. brads and plane down flush with the stiles. The shutters should be hinged to the casings, although they can simply be nailed to the walls.

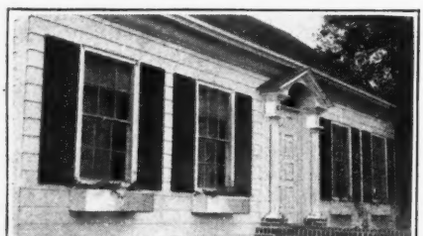


Fig. 2. Shutters of the Venetian or slat work type redeem the appearance of a plain house

An extremely simple type of shutter (Figs. 1 and 3) is that built of ceiling, which is tongued and grooved stock. Here the width is equal to one half of the window width plus the main casing width. Cut the pieces of 1 by 4 in. ceiling (preferably V-grooved) to approximate length, make 1 by 4 in. cleats with chamfered corners, and blind nail the ceiling to the cleats. Further nailing is done by driving two fivepenny box nails at various angles through each cleat into each board. Saw to length and joint the edges. Lay out the crescents at an angle, keeping them well above the center, and cut out with a compass saw. Smooth with wood rasp and sandpaper.

A purely ornamental type consists of two pieces of 1 by 6 in. wood nailed to short cleats, with a simple flower-in-pot design sawed out of the center (Figs. 1 and 3). Lay out, cut, and finish one board to use as a pattern for the others. Paint the shutters before nailing up.

Six separate boards, also spaced at the joints, are used in the shutter illustrated in the lower left-hand corner of Fig. 3.

Pleasing variations of texture may be obtained by dressing the wood with an adze, or with a scrub plane, and bolts may be substituted for nails. Pyramidal headed escutcheon nails driven over the structural nails likewise improve the appearance of shutters that follow a rustic design. Special hardware to imitate hand forgings also can be obtained.—E. L.

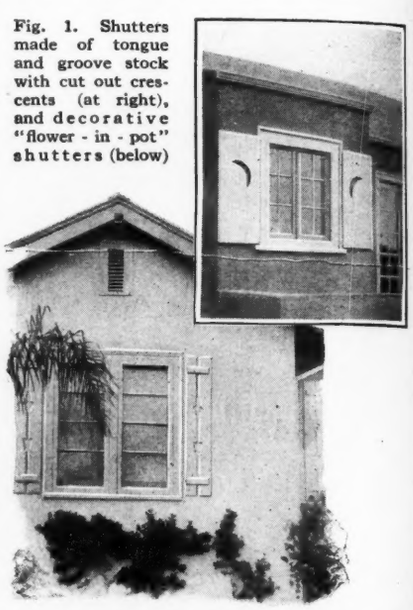


Fig. 1. Shutters made of tongue and groove stock with cut out crescents (at right), and decorative "flower - in - pot" shutters (below)

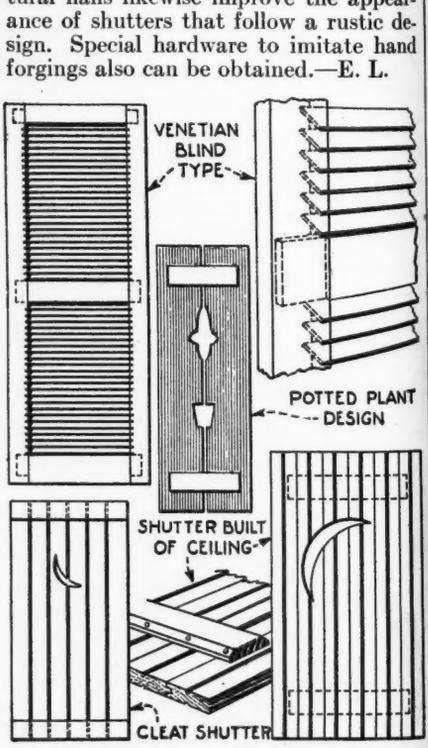


Fig. 3. Four types of ornamental window shutters the amateur mechanic can build

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FREE: New book on OIL HEAT for homes. Clip coupon below.

Now!

The New *Silent* NOKOL

automatic oil heat

See it in operation soon. Find out how noise has been cut to the vanishing point; how all past records of home-heating comfort are surpassed. Send coupon to learn where

THE entire oil heat situation has changed over night. A sensational comfort-development is now announced by the engineers who first made automatic oil heat a practical comfort for homes.

* * * *

Has the "noise bogey" made you hesitate to consider this modern comfort? *The new* Silent NOKOL *now cuts noise to the vanishing point!*

Have you thought automatic oil heat a high-cost luxury? For nine years NOKOL has proved the opposite—in thousands and thousands of homes. (Last winter in more than 29,000!)

Today even this record is surpassed. Even *more* comfort is provided—at even *lower* cost!

* * * *

Have you thought—or heard—that there is an unpleasant odor with automatic oil heat?

There is not, never was, never will be such odor—either inside or outside any NOKOL-*heated home.* Because NOKOL can and does give low-cost heat without having to burn cheap, foul-smelling oil—of which bad odor is but one disadvantage.

The secret is in NOKOL's famous combustion chamber. It does away with brickwork or other makeshift alteration of your furnace or boiler; scientifically adapts your heating plant for *oil* burning.

In the new Silent NOKOL *this combustion chamber is even more effective than ever before—and will outlast the furnace or boiler.*

AND NOTE THIS IMPORTANT FACT: NOKOL is one of the few automatic oil burners made in an adequate range of sizes to fit the wide range of heating-plant sizes. *Each installation is individually fitted to its particular furnace or boiler, its particular home or building.*

This sounds technical. But it is the basis of fully automatic heat with economy; of real, modern comfort. It makes your household master of its heat—not heat master of the household.

Where to see it—
(clip coupon)

Clip and mail the coupon below—and you learn where, in your own locality, the new Silent NOKOL may be seen in operation.

And you also receive, free, the most intelligent book so far written on the whole subject of OIL HEAT. Its language is clear, non-technical.

Now is the time to do this; mailing the coupon, today, is the way to start.

To THINKERS:

NOKOL gave automatic oil heat to the American Home nine years ago.

More homes have NOKOL today. than any other automatic oil heating service. At the end of 1925 more than $22,000,000 was invested in NOKOL equipment in American homes, and service had been extended to seven foreign countries. NOKOL sales to home owners, *now*, show a rate of more than $3,000,000 increase over 1925 business.

These thinking men and women have made this institution possible. Its success and permanency are founded on the tribute of a grateful public.

FREE: New Book

AMERICAN NOKOL CO., DEPT. 8
215 N. Michigan Blvd., Chicago, Ill.

Please send your "New Guide to Oil Heat for Homes"—and tell me where to see the new *Silent* NOKOL.

*Name*_____

*Address*_____

*City*_____

*State*_____

First domestic oil burner listed by Underwriters' Laboratories: approved by all leading Safety Boards. Manufactured and guaranteed by AMERICAN NOKOL COMPANY, Chicago.

THE NEW *Silent* NO COAL NOKOL
AUTOMATIC OIL HEATING FOR HOMES

At the Philadelphia Sesqui-Centennial Exposition: Palace of Liberal Arts and Manufactures, Group D.

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When The Talk Swings to Hammers

Bill (handing Art his hammer): "*There it is, son, 'D. Maydole' stamped right on th' head. A nicer balanced, finer made hammer isn't built.*"

Jack (filling his pipe): "*You said a mouthful, Bill. I've been using a Maydole ever since I was old enough to hold a hammer, an' I can't wear it out. That's 'cause it's made* **right.** *Th' head is* **press-forged.** *An' th' handle is th' finest hickory grown, air-dried for years. It's put on so it just* **can't** *come loose.*

Jim (between bites): "*Well, the folks that make 'em ought t' know how. They've been makin' hammers an' nothin else for more'n eighty years.*"

Art (the apprentice): "*Gosh' I'd better hide that nut cracker o' mine an' get a reg'lar hammer 'fore they find me out an' give me th' laugh. Me for a* **Maydole.**"

Do YOU appreciate what it means to you to be equipped with this superior hammer? Ask your dealer to show you the genuine Maydole and see for yourself why it's the choice of the great majority of experienced craftsmen.

Let us send you interesting and useful Pocket Handbook 23-B.

The DAVID MAYDOLE HAMMER CO.
Norwich New York

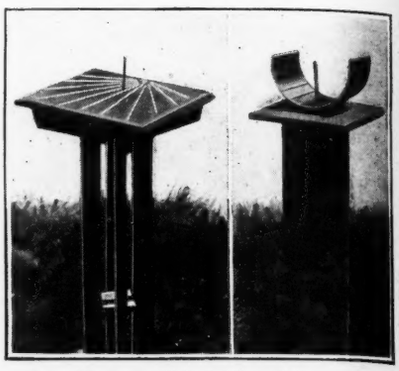
Maydole Hammers — Makers of YOUR HAMMER SINCE 1843

29

The Home Workshop

A Sundial for Your Garden

By Ernest Bade



In making a sundial of either of these types, the builder can add ornamentation to suit

SUNDIALS are among the most favored of garden ornaments. They are always interesting and picturesque, yet basically their construction is simple.

How accurate they are in telling the time depends upon the pains taken in making and setting the dial. Similarly, the pedestal can be made as plain or ornate as the builder desires.

Only the essential elements of sundial construction will be given in this article; the reader can use his own ingenuity in devising distinctive and beautiful embellishments.

Perhaps the simplest type of sundial consists of a thin sheet of metal, preferably brass, with a nail for a gnome (pointer). It may be prepared with ruler, shears and hammer and mounted on any suitable support.

The metal strip should be 2 or 3 in. wide and 12 in. long. Starting in the center, mark off 1-in. divisions on each side. These represent the hour lines. The center line represents the noon or midday point.

Bend the sheet metal into as perfect a half circle as possible, using a cylindrical form of some kind about 7 in. in diameter—a pot or large jar of the right size will do. Nail this curved piece to a support and place a vertical gnome 3½ in. in length on the southern side of the noon or midday line. The opposite end of the line must point to the north. A small pocket compass will be of sufficient accuracy to determine the north.

The more usual and more accurate type of sundial requires a preliminary drawing to be made with a ruler, protractor and compass. A dial of any size can be made.

For a dial with a 1-in. gnome, your paper should be 9 by 12 in. About 3 in. from the top draw the horizontal line XY,

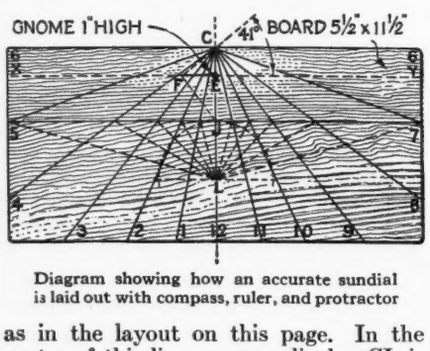


Diagram showing how an accurate sundial is laid out with compass, ruler, and protractor

as in the layout on this page. In the center of this line a perpendicular, CL, is drawn. The gnome is to be placed at point E.

The length of the gnome is measured from point E to point F on line XY; in this instance the distance will be 1 in. The gnome may be made any length desired, but it must be laid out at this point; it cannot be enlarged, at least for this drawing, at any later time.

Take a protractor and place the center mark at point F; then mark off the number of degrees latitude in which your home is situated. For New York City and its vicinity the 41-degree mark will be sufficiently close for this purpose. This factor can be determined easily from any map.

Draw a line from point F to the point marked off by the protractor so that it intersects line CL and mark this point C. A perpendicular—a line at right angles to FC—is now erected from line FC at point F; this line intersects line CL at J. You now have a small right triangle, CFJ.

THROUGH points C and J, lines parallel with XY are drawn. The line through C is the six-hour line, or the morning meridian. Point J is the noon or midday point.

To find the position of the other hour lines on the dial, a half circle is constructed, the radius of which is the length of line FJ. First mark off this distance, FJ, from J down the line CL. Place the compass at the point of intersection (L) and draw the half circle.

Then divide each half of the half circle into three equal parts by using the radius of the circle and marking it off on the circumference first from point J and then from each end of the half circle. Divide each of the six segments thus obtained into two equal parts by bisecting the angle geometrically, or find the center of each segment with a ruler, which is simpler but not so accurate.

When these twelve points have been found on the circumference of the half circle, draw dotted lines from the center of the circle through the points to the parallel line J. Draw heavy lines from point C through the intersections on the parallel line J. These lines, which are the hour lines, may be any length.

The half and quarter hour lines are found in a similar manner by a further division of the half-circle segments.

Care must be taken to mount the dial perfectly horizontal, and the gnome vertical. The length of the gnome is distance FE and its position on the dial is point E. The dial is so moved on its axis that it registers the standard time of the locality. It will always register correct sun time.

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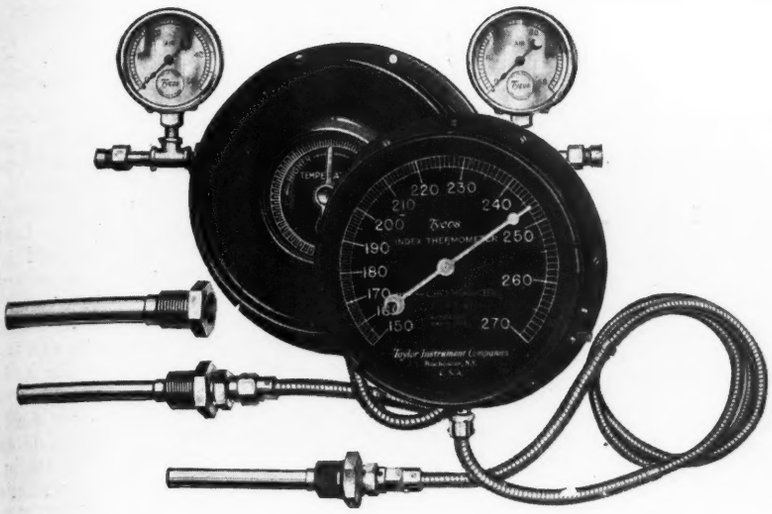

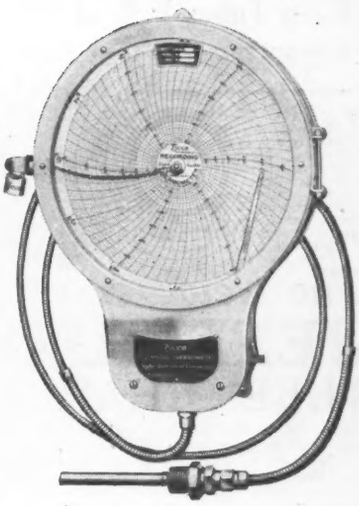

Metropolitan Life Insurance Company Improve the Efficiency of their Plant with

Tycos Instruments

Says J. F. CARMAN, *Chief Engineer*

"IN REPLY to your letter requesting an expression of how your *Tycos* instruments are working in the Home Office power plant, I am pleased to reply that the *Tycos* instruments play an important part in our constant effort to improve the efficiency of our plant.

"The *Tycos* Index Thermometers are used on each boiler flue so that the firemen can easily read the flue gas temperature.

"*Tycos* Temperature Regulators, automatically control the temperature of the fuel oil in suction line leading to our fuel oil pumps. They also are used to automatically hold the fuel oil temperature in the oil heaters at 180° Fahrenheit.

"The *Tycos* Recording Thermometers are used with great success in our ice cream hardening room and are used to check room temperatures throughout the Home Office.

"*Tycos* Hot Water Regulators are one of the best instruments, and successfully operate numerous heaters throughout the building, holding the hot water at 160° Fahrenheit. I have great faith in all *Tycos* instruments, many others than those specified are used to render service to the nine thousand and more employees here in the Home Office.

"We are grateful to you for the service we have received from your New York staff who have always been ready to co-operate with us."

TO MANUFACTURERS

In the *Tycos* line of 8000 different kinds of Heat Indicating, Recording and Controlling Instruments there are instruments that will help you take the guess out of your manufacturing problems. It will pay you to learn how other manufacturers are using the Sixth Sense of Industry to get uniform results. Informative literature on any type of instrument will be sent you on request. Or our engineers will consult with you on the application of *Tycos* to your particular manufacturing process.

Taylor Instrument Companies

Main Office and Factory
ROCHESTER, N. Y. - - U. S. A.
Canadian Plant: *Tycos* BUILDING, TORONTO
SHORT & MASON, Ltd., Manufacturing Distributors in Great Britain

Tycos — for the Home

Tycos Office Thermometers
An aid in promoting human efficiency.

Tycos Bath Thermometers
To enable you to get the most good from your bath.

Taylor Home Set
Bake Oven Thermometer, Candy Thermometer, Sugar Meter. The secret of accurate results in cooking.

Tycos Wall Thermometers
To help you maintain a temperature in your house conducive to good health.

Taylor Quality Compasses
To show you the right way in unfamiliar country.

Tycos Fever Thermometers
A necessity in every home.

Tycos Stormoguide
Forecasts the weather twenty-four hours ahead with dependable accuracy.

Tycos Hygrometer
To enable you to keep the humidity of the atmosphere in your home correct at all times.

Your dealer will show them to you. Ask us, on a postal, for booklets on any of the above

Tycos — for the Medical Profession

Tycos Sphygmomanometer, Pocket and Office types.
Tycos Urinalysis Glassware.
Tycos Fever Thermometers.
Bulletins on request.

THE SIXTH SENSE OF INDUSTRY

Tycos Temperature Instruments

INDICATING • RECORDING • CONTROLLING

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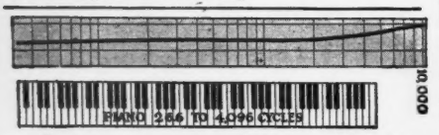
Keep Tubes Full of "Pep" Without removing them from set!

Tubes gradually "run down," as do batteries. Now it is easy to regularly recharge 201-A or UV-199 type tubes, all at once, at home, and enjoy topnotch reception at all times.

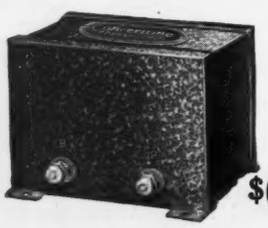
The New **$3.50**

JEFFERSON TUBE CHARGER

Tubes soon weaken with use, cut down the power of your set and take more current. To keep tubes always like new, at full efficiency—or to rejuvenate run-down tubes—attach a Jefferson Tube Charger to light socket and connect to set for 10 minutes once a month. The improved reception you get—plus longer life of tubes and batteries—will be worth many times the small price of $3.50. Guaranteed. Get one at your dealer's today.



The very nearly straight "curve" of the new Jefferson "Concertone" Sealed audio frequency transformer assures full amplification of all notes—from the lowest to the highest audible to human ears.



$6

Why the newest circuits use—

JEFFERSON Concertone

(AL-2 SEALED)

TO OBTAIN bass note amplification as well as natural life-like reproduction of all tones, your transformers must evenly amplify every note of the entire musical scale. Jeffersons are extensively used in high-grade receivers because they actually make the broadcast sound more natural and life-like.

Now, the adoption of the new big Jefferson "Concertone" audio frequency transformers in latest circuits offers further proof that Jeffersons excel in tone quality.

These new Jeffersons also increase sensitivity and improve distance reception. Ideal for use with power tubes because of their **heavily insulated,** extra large core and windings. Each transformer moisture-proofed by **sealing** it in 3½" square x 2¾" high metal case—convenient for "double-decking." List, $6.00 each. Get them from your dealer.

Write for Latest Literature. Other Jefferson Guaranteed Products: Jefferson "Star" A. F. Transformers, $2.75; $3.00; Jefferson Tube Rejuvenator, $7.50; Jefferson No. 280 Tube Charger with single socket for large tubes, $3.50; Jefferson No. 285 Tube Charger with single socket for small tubes, $3.50; Jefferson Tube Testers (for dealers and experimenters $8, $9. Write for literature.

Jefferson Electric Mfg. Co.

Largest manufacturers of small transformers

509 SO. GREEN ST. CHICAGO, ILL. U.S.A.

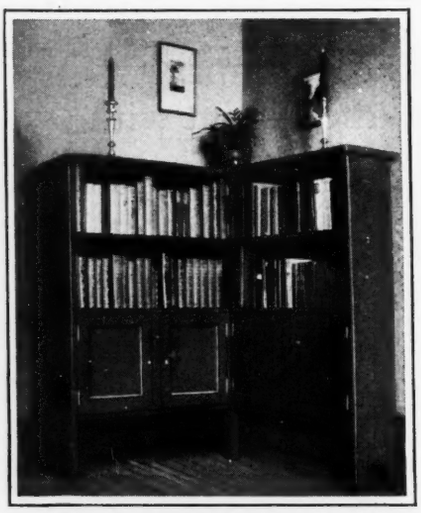
The Home Workshop

How to Build Neat Corner Bookcase

By S. J. Crawley

THE construction of this corner bookcase is so simple that no one should have difficulty in making a similar one. Oak, if stained dark, is an excellent wood to use as it shows off the bright colors of the bindings to advantage.

The shelves fit in dados (grooves) cut in the end pieces, but ½ in. is left uncut at the front so that the dado will not show.

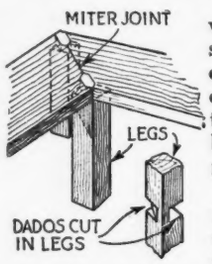


A corner may be furnished acceptably with a bookcase and cabinet of this simple design

Each shelf, of course, is notched at the front to fit.

The other ends of the shelves are fitted as shown in the drawing, and reinforced underneath with mending plates. Small strips are screwed on at right angles to the front of each shelf next to the legs, to prevent books from falling behind the legs.

It is advisable for the beginner, when cutting the miters of top and shelves, to tack on small straight strips of waste wood to guide the saw; also in making the dados in the end pieces.



How the shelves and corner legs are joined

The top is put on with angle irons so that the back edge projects enough to allow for the thickness of the baseboard and molding at the floor.

Fiber wallboard (it could be plywood) covers the entire back of each wing.

The doors are made with the usual mortise and tenon joints and the pieces are grooved ¼ by ¼ in. to take the panels, which are of plywood. If no plow plane is available, the grooves can be cut at the mill when the wood is ordered. A small molding is then glued and tacked around the panels.

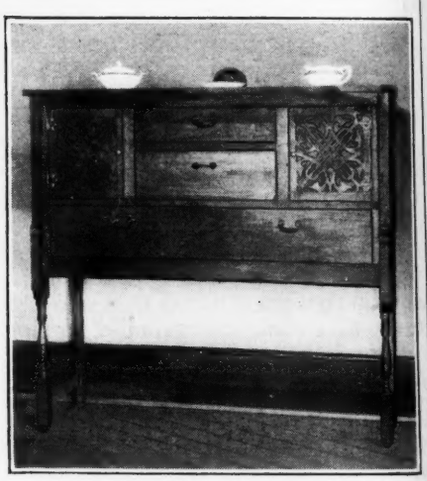
Strips to act as door stops are fastened inside each cupboard; small blocks also are placed behind the divisions between the doors. For additional strength the shelves are braced with angle irons. Locks or elbow catches, loose pin butt hinges, and wooden knobs stained to match (or metal ones), are the necessary hardware.

The length of the shelves or other measurements can be chosen to suit individual needs. In this case the ends were ¾ by 7 by 46 in.; the tops ¾ by 9 by 38, the six shelves ½ by 7 by 35¼; the two legs 1½ by 1½ by 46; the doors ⅝ by 12¾ wide by 15 high, with 2¼ in. wide lower rails and 1¾ in. upper rails and stiles.

Dining Room Server Made from an Old Reed Organ

SOME time ago I described in Popular Science Monthly an antique china cabinet I had made from an old reed organ. I have just completed a server for the dining room to match the china cabinet. It also was made from material from the walnut case of an old reed organ.

All of the old varnish was removed from each piece of wood as it was prepared for use in the server. I have no lathe for turning, but found the parts for the two front legs already turned. However, these turned parts were not long enough, so I pieced them out by gluing and screwing on ornamental cleats in front.



Fine walnut taken from an old parlor organ was used in making this serving table

All joints used were of the mortise and tenon type and were firmly glued. The two doors were made from scrollwork panels taken from the organ. The scrollwork was glued flat to another thin panel of wood of the same kind. By finishing the scrollwork in one tone and the ground in another, a two-tone effect was obtained.

After the server was assembled it was sandpapered thoroughly, given a coat of walnut stain, one of dark wood filler, and two of varnish. The last varnish coat was finished by rubbing with linseed oil and pumice stone.—R. E. D.

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COUNTERPHASE-EIGHT
and the NEW
COUNTERPHASE-SIX
permanent model receivers

While developing the working parts of the new Counterphase, the general appearance has not been overlooked. Cabinet designs incorporate some refinements which will appeal to those who want "something better."

Cabinet design of Counterphase-Eight. The controls are concealed by a hinged panel when the receiver is not in use and serves as a hand rest when tuning. Two-tone walnut finish.

Since broadcasting began Bremer-Tully products have been known the world over as superior. Advertising claims have been conservative and never beyond the possibilities of the products.

In the new Counterphase, Bremer-Tully believe they have succeeded in perfecting a receiver that will prove to be even more popular than the famous "Nameless" of three years ago.

The Counterphase cannot be made to radiate,—it has tone quality,—power for all requirements,—and Selectivity beyond even former B-T circuits,—operation is extremely simple,—and there is NO OSCILLATION CONTROL used, or necessary.

There is but one station selector—with a new patented indicating device that permits absolutely accurate calibration of each receiver.

Counterphase Cabinets likewise follow a new design that appeals equally to both men and women.

We are sure you will enjoy reading of the many new features and will gladly send full information on request, together with the name of the nearest authorized B-T dealer if desired.

DEALERS—SOME TERRITORY STILL OPEN TO HIGH-GRADE DEALERS

"BETTER TUNING"

"Better Tuning," the B-T booklet is known to millions. The 10th edition gives complete information on the new COUNTERPHASE set models. B Power Units described and explained in every-day language. Sent postpaid on receipt of 10c. Use the coupon.

☐I enclose 10c. Please send me postpaid a copy of the 10th edition "Better Tuning"

☐Send free circulars

☐I am a dealer and interested in becoming authorized to sell Counterphase Receivers

Name

Address

Bremer Tully

Manufacturing Company

520 So. Canal St., Chicago, Ill.

Thousands have asked for a B-T

B-POWER UNIT

Guess-work has been eliminated in the B-T B-Power Unit. Fixed resistances enable the user to know the exact voltage delivered to the set whether it be a three or a seven-tube set. We recommend it for use with B-T receivers. No better endorsement could be given.

A wonderful tool

New enough to be designed right, old enough to be proved right.

TWO years of testing inside our plants—three years of service in the world of tool users. That's the history of Millers Falls Spiral Ratchet Screw Drivers.

They are among the most popular Millers Falls tools, because they give such excellent performance, because they are so extraordinarily useful, and because men who know tools know they can depend on those of Millers Falls make.

No. 61, the all-round size, passed with high honors the rigorous tests of Popular Science Institute of Standards. It is about the finest tool you can own—does everything a screw driver can do, and does it easily.

MILLERS FALLS Spiral Ratchet Screw Driver

Nos.
61
62
67

Thousands of leading hardware stores carry them. No. 62 is the big size, for extra hard service; No. 67 the small one of the family. Nos. 610, 620, 670 are similar, but with Automatic Return feature.

Note these Points: Three actions—right or left spiral; right or left ratchet; plain screw driver.

Three blades—easily inserted, with positive lock; easily removed; special steel, blades tested individually.

Unique design of shifter; quick, positive action.

Look for the Millers Falls Automatic Tool Display in hardware stores.

MILLERS FALLS COMPANY
Millers Falls, Mass.
28 Warren St., New York
9 So. Clinton St., Chicago
Manufacturers of Mechanics' Tools, Hack Saws and Automobile Tools.

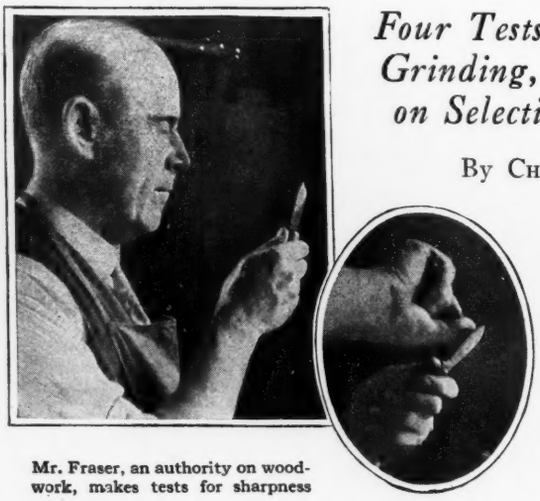
MILLERS FALLS TOOLS
SINCE 1868

The Home Workshop

How to Keep Your Knife Keen

Four Tests for Sharpness—Grinding, Honing—Hints on Selecting Pocketknives

By Chelsea Fraser



Mr. Fraser, an authority on woodwork, makes tests for sharpness

I WONDER if you will take out your pocketknife, open the most used blade, and hold it vertically before you as you see me doing above. Your back should be toward a strong light.

Scan the edge carefully from tip to base. Is it one long, bluish, indistinct line, so thin that it seems more imaginary than real? Or is the edge in places quite clear and distinct, like a white line? If it is, the blade has lost its keenness. To what extent, you can judge by the width of the white line.

Test it further by drawing the ball of the thumb lightly at right angles across the edge. If you notice a slight clinging effect, the blade is sharp. If it slips over the flesh very easily, it is dull.

Next, draw the edge of the thumb-nail along the blade. A sense of friction indicates that the blade is keen. If there is the most minute nick, this test will reveal it.

There is still another test—one I especially recommend your using when you buy a new knife. Take along a small hardwood block, say beech or maple, and, after picking out the style of knife you want, ask the salesman for permission to cut a thin shaving across the end grain.

If the blade is too soft, it will bend over along the edge and a sort of hook will be felt when the thumb is drawn across one side or the other of the blade. If, on the other hand, it is too hard, small particles are apt to break off the edge, leaving it ragged. If the blade is correctly tempered, tough and hard, the edge will remain keen and undamaged.

The best of knives, however, will not long give good service unless they are kept sharp.

Deep nicks should be ground out on a grindstone or an emery wheel. Lay the blade flat upon the tool rest so that the edge will come squarely against the wheel. Press lightly and draw the blade slowly and evenly back and forth across the stone.

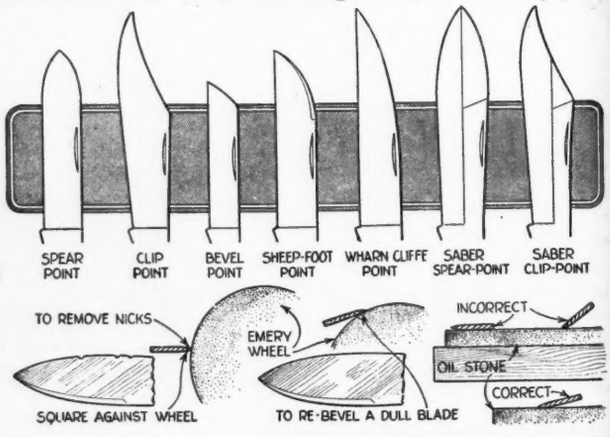
When you are satisfied that the edge is true, set the rest at the proper beveling angle, or hold the knife freely in the hand at this angle, and grind down both sides, moving the blade constantly across the face of the wheel while so doing. Exert very light pressure so as not to overheat the edge. Water should be poured on a grindstone during this process, and, in the case of an emery wheel, upon which water is never applied, the tool should be dipped frequently in water to cool it off.

Blades need to be reground only when very dull. Ordinarily it is sufficient to hone them on an oilstone. Indeed, even when they have been ground, the sharpening must be finished on a stone.

Slight nicks can be removed by placing the edge down squarely on the oilstone and working it back and forth. Clamp the stone in a vise or otherwise fasten it down, if possible, and lubricate the surface with clear oil, kerosene, or a mixture of half olive oil and half kerosene.

My method of honing is to place the blade across the center of the stone in such a way as to give the longest possible bearing upon the cutting bevel. I lay the tips of two fingers of my left hand upon the upper side of the blade, and work the steel back and forth from end to end of the stone, keeping the angle as shown in the illustration below.

After honing (*Continued on page 92*)



Some of the more common shapes for pocketknife and jackknife blades; how to remove nicks and regrind and hone a dull blade

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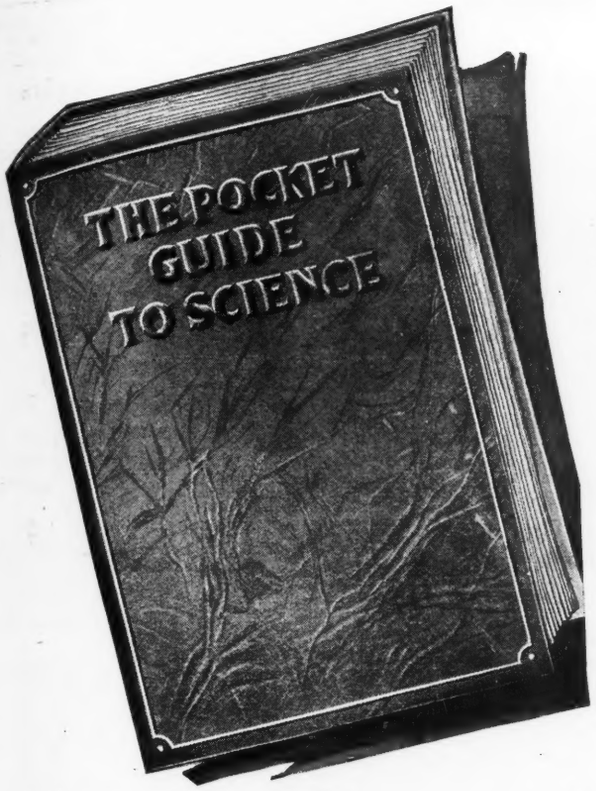

INTO THIS one brilliant book of 280 pages have been condensed the outstanding facts that scientists have discovered since Aristotle, the father of science, dissected a frog to see what made its heart beat.

How often have you wanted to know about the wonderful discoveries in science that have so changed the world we live in . . . the secret of radium . . . the romance of the atom . . . the origin of the earth!

Or you may have wanted to know why glass is transparent . . . how fireflies produce light . . . why the grass is green . . . if radio waves move in a straight line?

All of these questions, and hundreds of others, have now been answered, for the first time, in one book—THE POCKET GUIDE TO SCIENCE.

All that you probably will ever want to know about science is told in this one book that will fit in your pocket or grace a library table. The curiosity-satisfying facts about the world we live in are made instantly available to you in simple question-and-answer form in THE POCKET GUIDE TO SCIENCE.

Your Name in Gold
—on this Wonderful Book

YOU are assured of the accuracy of the answers in THE POCKET GUIDE TO SCIENCE because it has been edited by Dr. E. E. Free, the distinguished author of "The Story of Man and His World." Dr. Free has a remarkable genius for condensing the known facts about scientific questions into vivid, easily remembered paragraphs.

SPECIAL OFFER

THE POCKET GUIDE TO SCIENCE is not for sale. It is offered to you *without one penny extra cost,* with a 14 months' subscription to POPULAR SCIENCE MONTHLY.

In THE POCKET GUIDE TO SCIENCE you get full information of all that the scientists have discovered up to the summer of 1924.

POPULAR SCIENCE MONTHLY "carries on" where THE POCKET GUIDE TO SCIENCE leaves off. The POCKET GUIDE gives you all the information up to right now—POPULAR SCIENCE MONTHLY will give you all the important, interesting and new discoveries of science for the next 14 months.

In every issue of POPULAR SCIENCE MONTHLY are a dozen or more important articles that explain and picture the most fascinating and significant new developments, discoveries, and undertakings in exploration, in engineering, in health, in electricity, in medicine, and in every branch of science.

And there are also, in every issue, a hundred or more articles describing the important new inventions in every branch of mechanical activity—page after page filled with photographs and descriptions that show you how you can save money in the shop, around your car, in your store, office and home.

But all this is only part of the contents of one issue of the amazing POPULAR SCIENCE MONTHLY. It takes over 300 articles and pictures every month to tell the readers of POPULAR SCIENCE MONTHLY all that has happened in the scientific, radio, mechanical, and automotive fields.

A Few of the Hundreds of Questions Answered in the POCKET GUIDE TO SCIENCE

Why does static interfere with radio messages?
What gland makes people grow tall or keeps them short?
Why do we grow old?
What is the safest stimulant?
What is the function of the liver?
Why are tears salt?
Can energy be destroyed?
Why can't you skate on glass if it is smoother than ice?
How do self-winding clocks work?
Why does an iron ship float?
Can we see atoms with a microscope?
What are electrons?
Is electricity a form of matter?
What is a crystal?
How large is the universe?
Why do the stars twinkle?
How do we know what the stars are made of?
Is the inside of the earth molten?
What is an electric spark?
What makes the noise of thunder?

Your Name in Gold

We will stamp your name in 22-carat gold on the cover of THE POCKET GUIDE TO SCIENCE *at no extra cost to you* if you use the coupon below immediately.

You are offered a 14 months' subscription to POPULAR SCIENCE MONTHLY (regular price if bought by the month would be $3.50) with THE POCKET GUIDE TO SCIENCE—all for $2.95, plus the few cents' postage. If you are already a subscriber to POPULAR SCIENCE MONTHLY we will be glad to extend your subscription 14 months if you accept this offer.

In using the coupon please PRINT your name

POPULAR SCIENCE MONTHLY, 250 Fourth Ave., New York

SEND NO MONEY

Send no money, just the coupon. If within 10 days after you receive the book and magazine you decide that you are not satisfied in every particular you may return them and your entire payment will be refunded promptly and without question. Could any offer be fairer?

POPULAR SCIENCE MONTHLY
250 Fourth Avenue, New York

I accept your offer of THE POCKET GUIDE TO SCIENCE and a 14 months' subscription to POPULAR SCIENCE MONTHLY. I will pay the postman $2.95, plus the few cents' postage when he delivers the POCKET GUIDE and the first issue of POPULAR SCIENCE MONTHLY. If the book and magazine are not fully satisfactory to me I will return them within 10 days and you are to promptly refund my full payment. Please stamp my name in gold.

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P. S. 8-26

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A new camera—
3¼ x 4¼ Revolving Back
Graflex, Series C

with Cooke Anastigmat lens f.2.5

You have always known Graflex as the camera for extreme speed. The new, *f*.2.5 model has more than three times the lens speed of the fastest Graflex offered before.

With the Graflex, Series C, you can make successful snapshots regardless of weather. You can get striking story-telling pictures in the woods, even indoors, without keeping the subject rigidly still. Such pictures are of lively interest; they're the kind everybody admires.

Famous Graflex Features

Speeds are 1/5 to 1/1000, and the Graflex focal plane shutter lets in plenty of light. Proper exposure, which means detail, is easy.

Focus is sure. You see in the hood a reflected image, right side up, visible until you trip the shutter. You know when focus is sharp. The complete camera with Cooke Anastigmat *f*.2.5 is $260.

Other Graflex cameras from $58.50. Inquire of your dealer or write to Rochester.

Graflex cameras are now made by

The Folmer Graflex Corporation, Rochester, N. Y.

For sale by

Eastman Kodak Company, Rochester, N. Y.

KESTER
READY TO USE
METAL MENDER
The Household Solder

Here's why thousands use Kester Metal Mender.
Simple—"Requires Only Heat" Anyone can use it.
Safe—No messy pots or dangerous acids.
Sure—Genuine Solder makes firm metal joints.
Satisfactory—Works equally well on light or heavy, old or new work.
Economical—Saves many times its price.
Your Dealer Can Supply You

FREE SAMPLE Upon Request

CHICAGO SOLDER COMPANY
4201-322 Wrightwood Ave., Chicago, U.S.A.

$5 BIASCOPE
SIX-POWER
American made Binocular

Wonderful for outdoor folks, farmers, hunters, fishers, campers, tourists, scouts, naturalists. Lighter, more compact, easier to adjust, equal to many foreign glasses costing much more. At dealer or direct, postpaid. Money back guarantee.

POCKESCOPE
THE POCKET TELESCOPE
Practical 6-power telescope. Fits the vest pocket. Complete with case, $2.00. At dealer or direct, postpaid. Money back guarantee.

WOLLENSAK OPTICAL COMPANY
927 Hudson Avenue Rochester, N. Y.

The Home Workshop

Keep Your Knife Keen

(*Continued from page 90*)

both sides of the blade, wipe off the surplus oil and test for wire edge by drawing the sides slantwise across the ball of the thumb. If you have carried the honing process far enough, one or the other side will have a sort of hooked roughness where the exceedingly thin edge has been bent over.

The wire edge can be removed in two ways. One method, a rough and ready one, is to hone it down with lighter pressure. The other, for finer results, is to strop it off by "wiping" the blade upon a piece of oiled leather or an oiled basswood block. A mechanic sometimes strops the blade on the palm of his left hand.

Oil the blades and joints lightly with a good grade of thin machine oil. Avoid cutting apples, oranges and lemons with the knife, but, if it must be done, be sure to wipe the juice off with a dry cloth. If

When honing his knife, Mr. Fraser takes long strokes back and forth on the oilstone

water gets into the knife, dry the blades and the interior at once.

To remove rust or discoloration from the blades, rub them with fine emery cloth moistened with kerosene.

Incidentally, notice the uses to which you commonly put your pocketknife so that when you go to buy a new one you will be able to select the size and style of blades that will best serve your purposes.

For ordinary whittling and all-around cutting the spear point blade, called a pen point in the smaller sizes, is considered the best. The clip point is useful for working in recesses and for carving. The bevel point is excellent for cutting paper, cardboard and cloth, and it is also a good veiner and chipper for carving. The sheep-foot point is useful for sharpening pencils, scribing, and some types of carving. The Wharncliffe can be used for the same work, but possesses a slimmer point. The various saber points are for heavier cutting. Farmers, nurserymen and those interested in gardening will find a pruning blade of advantage, and a budding blade has no superior for grafting purposes.

Another important consideration is to buy a pocketknife that will open easily, yet with blades that will spring shut when about two thirds closed.

IODINE stains may be removed from white goods by dipping in limewater that has been heated to the boiling point, and then rinsing in clear water. Grease spots of animal or vegetable origin also may be removed by soaking the fabric in limewater, rinsing, and washing with soap.

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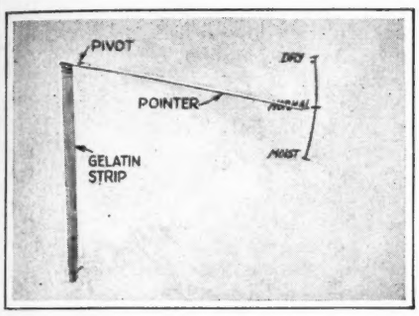
Home Workshop Chemistry

Simple Formulas that Will Save Time and Money

GELATIN, like carpenter's glue, is obtained from bones and skins. The purest gelatin may be obtained from the grocery store; a harder type is employed for photography and may be purchased in stores handling photographic supplies.

An absolutely colorless liquid glue may be prepared when required for special purposes by covering gelatin with cold (not warm or hot) water and permitting it to swell for a few hours. The excess water then is poured off and the mass is heated slowly in a water bath (a double boiler or a gluepot) until it melts. Acetic acid is added, a small quantity at a time, until it is found that the cold mass will remain liquid. This may be clarified, if necessary, by the addition of one part of



Gelatin and wire used to make a simple hygrometer for telling the moisture content of the air

ammonium fluoride for each 100 parts of gelatin solution.

Gelatin is also an ideal substance with which to make an accurate hygrometer for telling the moisture content of the air at a glance. A strip of gelatin ⅛ in. wide, 6 in. long, and as thick as thin paper, is needed. If such a strip cannot be purchased, it may be made by dissolving gelatin in water, pouring the solution on a piece of glass and allowing it to dry. If too thin, two or more layers may be deposited, one on top of the other.

The lower end of the strip is pinned to the wall. The upper end is folded over a thin wire by making a tiny fold in the strip, moistening it, looping the wire, and bringing the fold over the wire. But before this is done, the wire must be bent into a tiny loop ½ or ¾ in. from the gelatin. A pin is driven through this loop into the wall to act as a pivot.

The wire is cut off far enough from the loop so that its weight will overcome the weight of the gelatin. When the air is moist the gelatin expands; when it is dry, the gelatin contracts.

As a reminder the following label may be pasted upon the gelatin container:

Gelatin

Keep in a dry place or bottle tightly. Moisture spoils it.

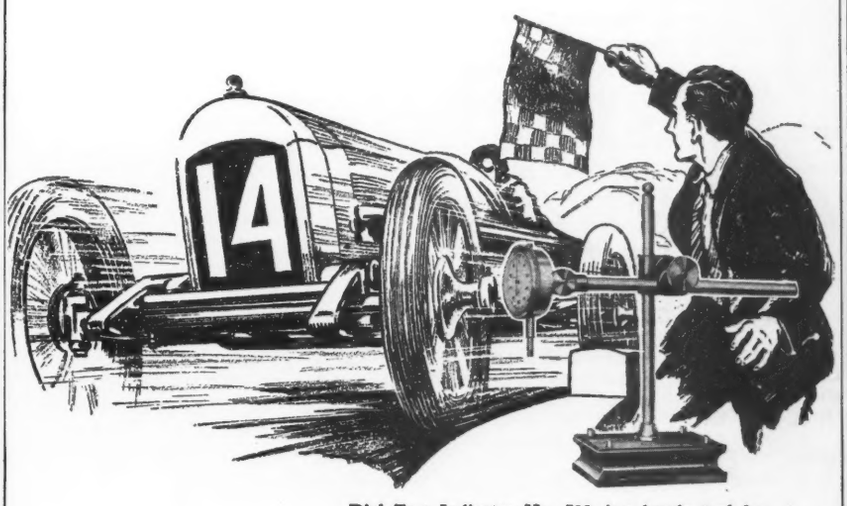
Makes a penetrating, water clear glue. Soak in cold water, pour off the excess water, melt in double boiler, and add acetic acid in sufficient quantity to prevent glue from jelling when cold.

Prrrrrrt!! and *flash*, a car sweeps by—a race is won! —*and Good Tools Play Their Part*

Almost invariably, the outcome of a race depends upon the mechanical superiority of the winning car. Its mechanical superiority may depend upon the use of more care in its original construction or more accurate adjustment in tuning up immediately before taking to the track. In either case, however, to gain the victory, good tools are necessary—tools of Brown & Sharpe Quality.

You may not be called upon to adjust a racing car for its breath-taking whirl around the track, but no matter whether you work in shop, garage, or at home, you know there's no more certain way to be sure your work is right than to use tools of Brown & Sharpe Quality.

Send for the Brown & Sharpe Small Tool Catalog No. 30. It contains 448 pages, each one of which holds something of interest for you. Write for your copy today.



Dial Test Indicator No. 733 is a handy tool for motor machinists. It is but one of the hundreds of Brown & Sharpe Tools in daily use in the manufacture of automobiles.

Ⓘ

BROWN & SHARPE TOOLS

BROWN & SHARPE MFG. CO.

Providence, R. I., U. S. A.

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Every Handy Man needs SMOOTH-ON NO. 1

SMOOTH-ON No. 1 hardens like iron and expands in doing so to make cracked, open or loose parts everlastingly tight. *Don't pay any professional fixer a big price to make such repairs.* With Smooth-On No. 1, you yourself can do a perfect job *for a few cents* and usually *in a few minutes.*

Get the Smooth-On habit and you will quickly find that it keeps many dollars in your own pocket. Try it on the following and see for yourself:

IN THE HOME

Stopping leaks in steam, water, gas, oil or stove pipes, mending cracks, breaks or leaks in furnaces and boilers, radiators, tanks, sinks, pots and pails, making loose handles tight on umbrellas, knives, hammers, brushes, drawers, etc., tightening loose screws, hooks, locks, door knobs, etc.

ON THE AUTOMOBILE

Making bursted water jackets and pumps good as new, stopping leaks in radiator, hose connections, gas tank and gas, oil and exhaust lines, making a fume-proof joint between exhaust pipe and tonneau heater, tightening loose headlight posts, keeping grease cups, hub caps and nuts from loosening and falling off, etc.

Write for FREE BOOK

To get perfect results, write to us for and *use* the Smooth-On Repair Book. Free if you return the coupon.

Get Smooth-On No. 1 in 7-oz., 1-lb. or 5-lb. tins at any hardware store, or if you want us to send sample 7-oz. can, enclose 35 cts. in stamps when returning the coupon.

Smooth-On Mfg. Co.
Dept. 58, 574 Communipaw Ave.
JERSEY CITY, N. J.

Do it with SMOOTH-ON

SMOOTH-ON MFG. CO., Dept. 58,
574 Communipaw Ave., Jersey City, N. J.
Please send the free Smooth-On Repair Book.

Name.....

Address.....

.....

Return this coupon for a FREE copy of Booklet

The Home Workshop

A Real "Rise-and-Fly" Model

(*Continued from page 70*)

dercarriage Q full size on a board and drive nails around the outline. Soak the reed in water, put it in the form, and dry in an oven. Do not get the reed too hot or it will become brittle.

The undercarriage is attached to the fuselage with small brads pointed at both ends. One end is driven into the longerons, and the undercarriage ends are forced onto the projecting points. The ends of the undercarriage struts should be reinforced by being bound, as also should the longerons at the points where the undercarriage struts are fastened. The fastening of the undercarriage is completed by passing a piece of wire, R, about 23 gage brass, through a hole drilled near the ends of the struts, bringing it around the longerons, and twisting the ends lightly. Put a drop of glue on the end of each strut as you fasten it to the fuselage.

THE axle, P, made from 1/32 in. diameter piano wire, should hold the wheels 5 in. apart. The wheels are kept from slipping off by curling the ends of the wire into small loops. The wheels Y are 2 in. in diameter and 3/32 in. thick, of three-ply basswood veneering. The axle is bound to the undercarriage struts with silk thread and glued.

The tail wing or horizontal stabilizer has a rear spar, G, of white pine 5/64 by 1/8 by 12 in. It should be bound at the ends to prevent splitting. The leading edge H is of 1/8 in. diameter reed, 14 in. long. This also should be bound at the ends. Drive a small brad through the reed near the end and then force the brad into the end grain of the spar. The rib, J, is bamboo 1/16 by 1/8 by 4 in. It is not curved as the tail must be flat. The covering will hold it securely. Make certain the rib is in the center to assure symmetry.

The main wing has eleven bamboo ribs D 1/16 by 3/32 in. in cross section. It is 6 1/2 in. wide at the center and 3 in. wide at the tips. The wing span is 36 in. The center rib has very little curve as it must not interfere too much with the rubber. The ribs having the greatest curve are those on each side of the center rib; the curve then lessens gradually with each succeeding rib and the tip rib has very little curve. It is well to draw a plan view of the full wing size before starting to assemble it.

The front spar is straight in plan view and the rear spar swoops forward to make the taper in the wing. The spars C are straight grained white pine, a scant 1/8 in. by 5/32 in. in cross section.

To obtain the bend at the center of the rear spar (the spar runs straight from the center bend to the ends), heat it over a candle, but be careful not to char or crack the wood. The wing spars should be sandpapered and the corners slightly rounded off.

After the spars are completed, the rib locations are marked and the curved ribs are bound in place with silk thread, using a drop of glue under each rib. About five wraps of silk thread each way on each end are sufficient. Before the glue dries at the joints, twist the frame this way and that slightly to get the warp out and make sure the ribs are crossing the front spar at right angles.

The main wing and the tail wing are covered on the top side only; the rudder is covered on both sides (U, V, W). The covering can be glued to the frames, but glue is heavy. A lighter job can be obtained by using nitrate dope or bamboo varnish. Cut the silk covering so there is about 1/2 in. margin all around the frame. Smear glue lightly or nitrate dope or bamboo varnish heavily over the parts of the frame where the silk is to come into contact. Lay the silk on the frame and smooth out the wrinkles. After the silk has dried in place on the frame, give it a coat of nitrate dope, brushing very lightly, or if you use bamboo varnish, apply it somewhat more freely.

While the tail wing is drying lay weights on it to keep it flat. The main wing, however, must have a dihedral angle. As the varnish dries and the silk draws up, the wing will assume its own dihedral. This must be controlled, though, by laying a weight on the center to keep it flat against the table. Now block each tip of the front spar up 4 in. off the table and each tip of the rear spar 3 in. off the table. The front spar must have a greater dihedral than the rear spar. Let the surface dry thoroughly overnight before removing from blocks. After the wings and the surfaces are dry trim off the margin with a sharp knife.

The last and most important part to be made is the propeller, K. It is carved from a soft white pine block 5/8 by 1 1/4 by 12 in. Make a paper pattern and then draw a line around it to mark the blank outline on the block. Cut with a knife along the outline to form the blank.

BEFORE starting the actual carving a 1/32-in. hole for the shaft should be drilled in the exact center of the blank. The blades should be concave on the back and convex on the front side. The contour of the cross section is such that it resembles a wing curve. The propeller when finished should be light, true and smooth. Sandpaper it and balance carefully so it will not vibrate when running. To reinforce against splitting, cover the blades with silk from the tips to about half way to the hub.

The propeller, fuselage and undercarriage should be varnished with nitrate dope or bamboo varnish.

The propeller shaft N is piano wire 1/32 in. in diameter. Put the shaft through the hole, bend it over, and force the end into the wood at the hub.

Place several washers on the shaft at the back of the propeller to keep it about 1/8 in. from the end (*Continued on page 95*)

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The Home Workshop

A "Rise-and-Fly" Model

(Continued from page 94)

of the bearing. Run the shaft through the bearing and turn into a hook. An S-hook (T) should be made of piano wire to hook into the eye of the rear hook, so that the rubber may be attached.

This model requires from twelve to fourteen strands of ⅛-in. flat Para rubber for the motor.

The tail fastens to the under side of the fuselage, with the round edge to the front and the covered side up. It is held in place by looping a rubber band over the fuselage and under the tail. The main wing is held the same way with a rubber band; it goes, however, on top of the fuselage, but under the rubber motor.

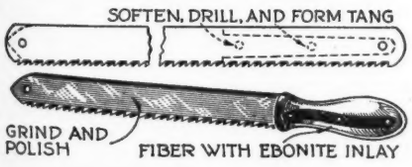
TO FLY the model, place the main wing along the fuselage with the front spar about 10 in. from the propeller. Wind the propeller about 100 times. Hold the machine above your head in one hand and the tip of the propeller in the other. Cast the model from you in level flight with the wing. Should the machine dive to the ground, move the wing forward a trifle; if it shoots up, stalls and then dives, move the wing back slightly. After a few trials you will find the proper adjustment.

Make the first trials when there is very little wind. After you learn the machine you can get perfect flights even on very windy days. To wind the machine up tightly, wind until there is a double row of knots in the rubber.

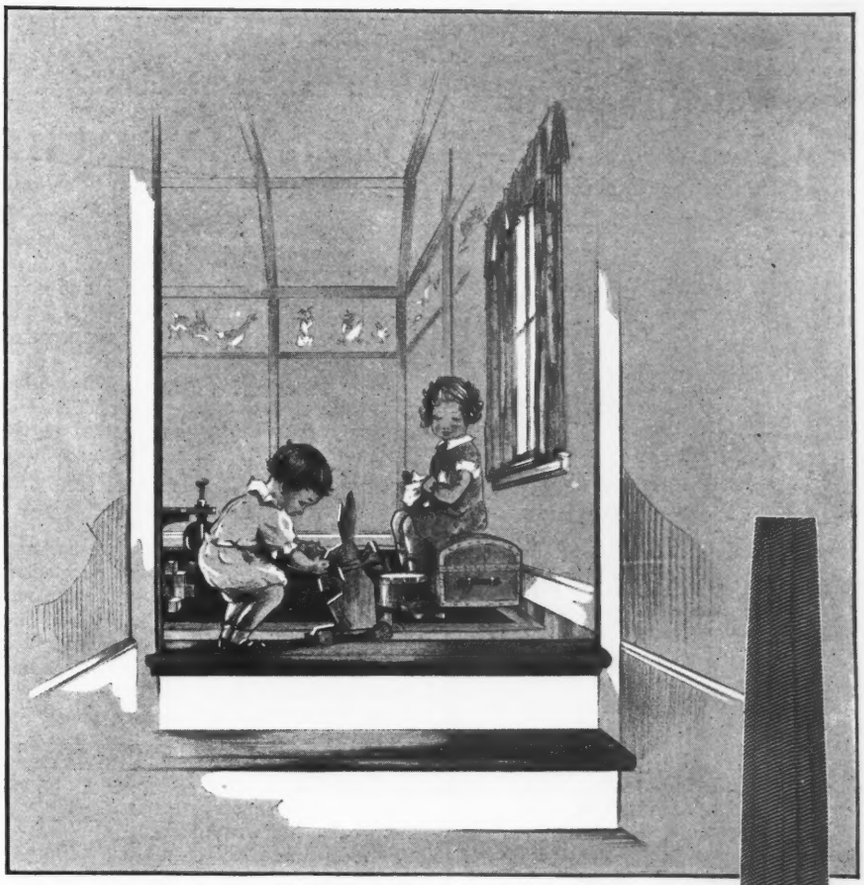
To make a rise off the ground flight, wind up fully and set the model on a fairly smooth surface where it can run along five or six feet.

You will find that the work of making a model of Mr. Bunch's design will be much easier if you obtain Home Workshop Blueprint No. 50, in which is incorporated all the essential details, a full size plan of half the wing, a full size detail of the propeller, and a completely itemized bill of materials. These are based upon drawings made under Mr. Bunch's own direction, and can be obtained for 25 cents from the Blueprint Service Department. See page 105.

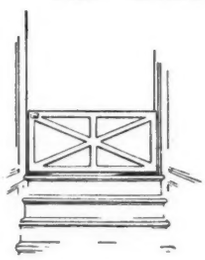
Bread Knife Made From Saw



AN EXCELLENT bread saw—better than usually can be purchased—can be made from an old power hacksaw blade. Grind the blade on both sides to make the toothed edge about 1/32 in. thick, and shape the end as shown. The hole does for hanging it up. Soften the other end, taking precautions not to draw the temper of what is to be the blade, and drill and grind it to fit the handle, which may be hardwood or fiber, inlaid with ebonite. Buff and polish.—F. H. TAYLOR.



There Should Be A Gate At The Head Of These Stairs



It's lucky for the youngster at the head of the stairs that he's only in a picture —or he'd probably take a tumble, and perhaps get badly hurt.

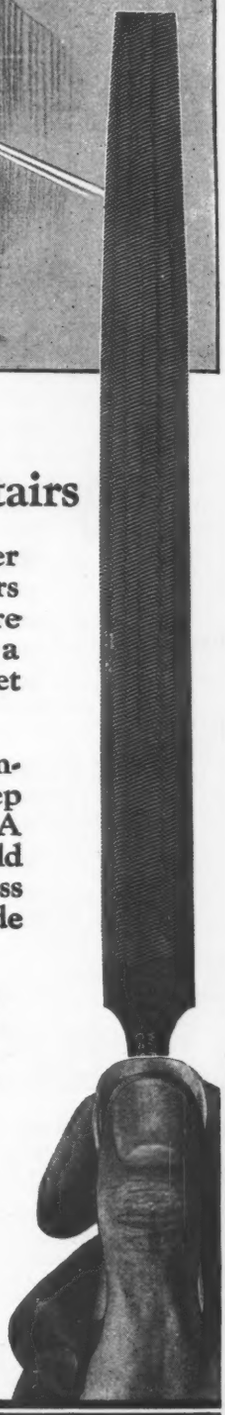
With good tools it is comparatively easy to build a gate to keep children from falling downstairs. A NICHOLSON Cabinet File should be used to shape the ends of the cross bars and smooth the ends of the side pieces.

NICHOLSON Files can do dozens of useful things about the home. Get these keen cutting durable files from your hardware dealer. He will be glad to supply your needs.

NICHOLSON FILE CO.
Providence, R. I.

NICHOLSON U.S.A. (TRADE MARK)

~a File for Every Purpose



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No Hide-and-Seek to Watch Them Run

MACHINES will *wire* you how they're running—if connected with Veeder *Magnetic* Counters. From the shop, they'll send their production reports *to your office.*

Visible on the dials over your desk, you can watch their records, "boss" their running or direct their development with this new

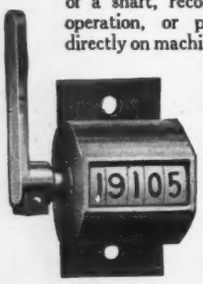
Veeder

The "Form UM" Magnetic Counter below counts operations or units of output, from any distance that wires connect with machines.

Cut ½ Size

Mechanical contacts on your machine make and break the electrical circuit which operates the counter. The electro-magnetic drive can get its current from your regular lighting circuit, (110 volts) or from storage battery.

The small Revolution Counter below registers one for a revolution of a shaft, recording a machine operation, or product. Goes directly on machine; non-magnetic.



Its mechanism will stand a very high rate of speed, making it especially suitable for light, fast-running machines. If run backward the counter subtracts. Price $2.00. (*Cut 4/5 size*). Small Rotary Ratchet Counter, to register reciprocating movements of small machines, also $2.00.

Write us for booklet on Mechanical Counters, or bulletin on Magnetic Counters—or both.

The Veeder Mfg. Co.
44 Sargeant St., Hartford, Conn.

The Home Workshop

My Adventures in Toolcraft

(*Continued from page 67*)

so that the car wheels may pass over it easily.

Saw cuts may be made along the inner side of a curved wooden strip, if the curve is to be a sharp one, as shown at E. The sharper curves should be banked, so that the car will stay on the track.

Window pulleys were used as car wheels (Fig. 2) and mounted on a short piece of board. Slots were cut in the bottom of the board so that the wheels would run clear. A cigar box was nailed to the platform to complete the car.

Several such cars may be made with different bodies to represent passenger or freight cars, or even steam or electric locomotives as shown in POPULAR SCIENCE MONTHLY Blueprint No. 14. By building a simple gravity railroad of this kind, a youngster will learn much about laying track, banking curves, switches, and the like.

I THINK I got more real thrills out of playing with this homemade toy than many a modern boy gets out of an electric train, though you may be sure that I should have been glad to have one if they had existed then.

Another stunt I did in those early days was to rig up a real cable road (aerial cableway) on which I could ride and did—once.

My father and mother being out buggy riding, I found a barn door pulley among the many treasures in the barn, took down the family clothesline, which fortunately was a strong one, and fastened one end of it way up in a pear tree and the other end to the outer wall of the kitchen, perhaps thirty-five feet away. My car was soon made of a packing box large enough for me to get into. This box was hauled up the pear tree with my trusty pulley tackle and attached with ropes to the barn door pulley, which already was mounted on the wire. I had to work fast against my parents' return, and did.

At last all was ready. I climbed in the box, let her go, and sailed through the air, down the wire. A great thrill, as I remember it, ending with a glorious crash against our kitchen siding, just as my horrified parents drove down the lane. Nothing was hurt, except the kitchen; it took a good carpenter a day to fix that, and I had to stand up to eat my supper.

But the thrill of this forbidden pleasure lasted, and it was not long after that my chum and I built a gravity road on which we could ride. The track was made of two by fours to which were screwed the half-round iron bars used for the barn door track. Barn door wheels were screwed to a box for a car.

Our back yard became very popular. Thus encouraged, we built a similar but much longer and more elaborate outfit in the steeply slanting back yard of another chum of mine. This road had a curve and a tunnel, and the rails ended up a steep incline against a tree at the end. This was quite an ambitious undertaking and took all our spare time for a week. At last it was completed.

Did we try out our car with a load of stone first? We did not! Present on this great occasion was a very strong-willed girl with red hair, quite the boss of our gang. She insisted on the first ride alone. She had it. Just before the car entered the dark tunnel, it struck the curve and left the track with the result that the red haired girl sailed through the air and was caught in the arms of the toughest boy in town, in the most approved movie style, only we had no movies then. However, we banked the track about the curve, built in a guardrail or two, and then our road was a success.

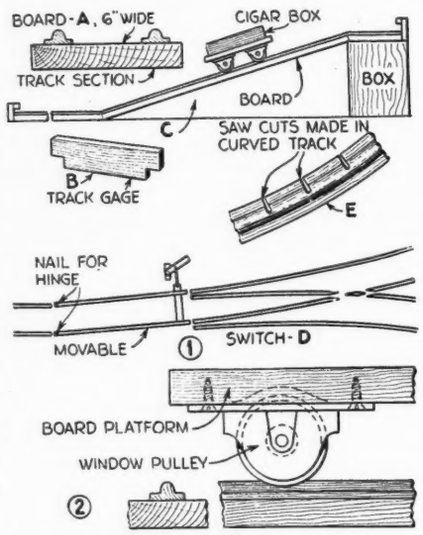


Diagram showing how Mr. Thatcher made his first toy railway with window pulleys for wheels and cigar boxes of different sizes for cars

I REMEMBER making a merry-go-round on which we kids could ride. This was built under the barn shed.

The elevation of the merry-go-round is shown in Fig. 3, page 97. The old signpost in the center was 8 ft. high and about 8 in. in diameter; that is, one end was buried in the ground so that the top of the post was 8 ft. above ground. It was firmly guyed to the sides of the shed by the guy wires indicated at the top.

The iron ring with three legs riveted to it was an old, handmade kitchen boiler stand. A modern kitchen boiler stand is a sort of three-legged tripod arrangement not at all suitable. The ring illustrated may be made by any blacksmith and it should not cost much. The one used on my merry-go-round was about 16 in. in diameter (outside) and ¼ in. thick. The three legs riveted to it were made of the same stock and were about 8 in. long; 4 in. would be plenty long enough.

The rollers were taken out of the cast-iron casings of ordinary window pulleys and six of them (*Continued on page 97*)

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The Home Workshop

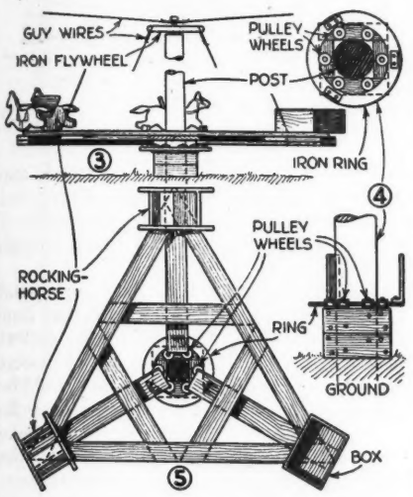
Adventures in Toolcraft

(*Continued from page 96*)

were mounted on a wooden framework, which was made in the form of a square and nailed firmly to the base of the pole (Fig. 4). Large nails were driven through the pulleys into the frame, a washer being placed under each pulley. Plenty of axle grease was spread about the ring.

At the top of the pole was mounted a heavy iron balance wheel from an old hay cutter, from which guy wires descended to the platform.

The details of this platform are shown in Fig. 5. It was triangular in shape and made of 8-in. boards, the triangle being perhaps 8 ft. on a side. In one end of each of the three boards running to the points of the triangle, a slot was cut to slip over one of the legs riveted to the ring. Three



Partial elevation and a plan view of a small merry-go-round; details of the roller bearings

crosspieces were used to hold the slotted ends of these boards in place, as shown. My recollection is that the two rocking-horses and the box were held in place with small angle irons and screws.

If you make a merry-go-round such as this, it may be painted with bright colors, the wheel at the top gilded, and flags and bunting draped about, and a phonograph used for the "organ."

Many years later I used the same plan to make a much larger merry-go-round for our annual festival. It was quite a grand affair. Three wooden animals, elephant, ostrich, and donkey, and three boatlike cars were mounted on a circular platform, the whole being painted with the bright colors dear to children, and there were flashing mirrors made of the tin disks used for roofing-paper, gay flags, and tinsel. A mail order hand organ furnishes the music.

Twenty people could, and do, ride on it with safety. It is run by hand power, but as it turns so very easily the motive power jumps on and takes a ride now and then.

Next month Mr. Thatcher will tell a simple way to make beautiful hammered copper bowls.

We're Sending Men

10-day tubes of Palmolive Shaving Cream, free, to prove its case.

GENTLEMEN:—We have a shaving cream that softens the toughest beard in one minute—that does things, men tell us, no other shaving preparation before it has ever done.

Its success is a national sensation. Thousands of men, once wedded to rival preparations, are flocking to it. Eight in ten who try it become enthusiastic.

Now in courtesy to us, will you accept a 10-day tube to try?—give it a chance to prove its claims to you?

* * *

We are the makers of Palmolive Toilet Soap. Are soap experts, as you know.

Now the best that we know, we've put in this new creation. In this amazing shaving cream, which, in a short time, has gained high place in the field.

Over 60 years of soap study stand behind it. There is no other like it. We made it to the expressed order of 1000 men who told us their supreme desires in a shaving cream, plus a fifth. . . strong bubbles . . . the supreme requirement of all. We made and tested 130 formulas before perfecting it.

Note these five

1—Multiplies itself in lather 250 times.
2—Softens the beard in one minute.
3—Maintains its creamy fullness for 10 minutes on the face.
4—Strong bubbles hold the hairs erect for cutting.
5—Fine after-effects due to palm and olive oil content.

Send the coupon .

You may think your present cream is supreme. But you can't be sure without trying this new creation.

Let us send you a tube . . . both for your sake and for ours. We'll rest our case on what you find. Send the coupon. Mail it before you forget.

THE PALMOLIVE COMPANY (Del. Corp.)
CHICAGO, ILLINOIS

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"If you can whistle a tune you can play a Lyon & Healy Sax" —says Richard Dix

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Richard Dix—

Richard Dix, popular screen star, hero in "The Quarterback" and other feature films, pictured above with his Lyon & Healy Saxophone—he certainly knows what he is talking about. Why should you envy the other fellow his popularity, good-times, leisure, extra spending money, when you can enjoy the same things too?

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You can quickly learn to play a Lyon & Healy Saxophone because—with our sixty years musical experience to guide us—we have simplified the fingering, made it easy for you to play, easy to produce full, rich tones. The Lyon & Healy is the choice not only of noted amateurs like Richard Dix, but of leading professional players as well, because of its extremely accurate adjustment, improvements in key action for hair-trigger finger work, perfection in pitch and resonant and mellow tones. Remember—it is made and guaranteed by America's leading musical house!

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The Home Workshop

Dressing Up an Old Fireplace

How to Replace Dilapidated Brickwork and Lay an Ornamental Hearth of Tiles

By E. E. Scott

MUCH has been said and written about a fireplace being the center of the home. Few modern small houses are built without one, but in the case of dwellings built on a speculative basis, the fireplace is frequently made of common or second quality brick of poor appearance. The hearth, too, is rarely of real tile; it is usually cement or common bricks. Poorly made cement hearths are apt to crack and brick hearths become discolored.

A fireplace of the cheap variety, shown in one of the views below, was re-faced with tapestry brick at a cost of eleven dollars.

The first step in such a job is to take off the mantel. The old facing bricks are readily removed by holding a cold chisel against the mortar seam and striking it a smart blow. If the hearth is of common brick, the same method may be followed, but if it is of cement, it should be broken up with a sledge hammer or the back of an ax.

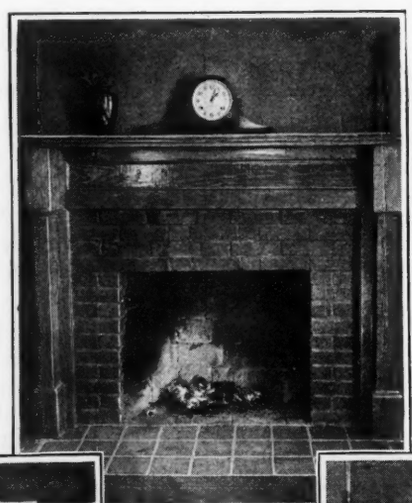
The facing should be replaced first. If a rectangular opening is desired, a frame of two by fours like that illustrated on page 99 should be built. If an arch is preferred, the upper part must be built up in the curve required. This is done by cutting two 1-in. boards to the correct curve, fastening them to the top of the upper two by four, and then nailing 1 by 4 by 4 in. pieces across their upper edges.

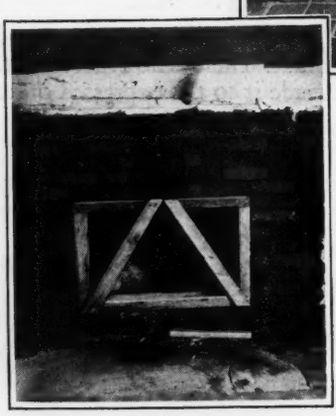
The only materials needed are the bricks, usually from 60 to 80, one bag of Portland cement, 5 lb. of lump lime, and 1 lb. of coloring matter for the mortar. If dark grey is wanted, lampblack may be used and obtained from a hardware store, but regular mortar colors are preferable if they can be obtained in a small enough quantity.

The mortar should be two parts sand and one part cement with sufficient lime added to make the mixture appear sticky. About 1 lb. to a bucket of mortar will be sufficient. The lime first should be slaked by placing it in a pan with sufficient water to make a paste when the slaking action ceases. This paste should be stirred into the mortar.

The tools required are a small flat trowel, a hammer, and a level. The method of laying the bricks is familiar to everyone. The only precaution necessary is to use a level horizontally and plumb

(*Continued on page 99*)





The rebuilt fireplace is illustrated in the view shown above. Note the neatness of brickwork and tiling

At the left is shown the wooden framework used for supporting the new brickwork during period of construction

The old fireplace is shown at the right. The bricks are of common quality and the hearth is cracked

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The Home Workshop

Dressing Up a Fireplace

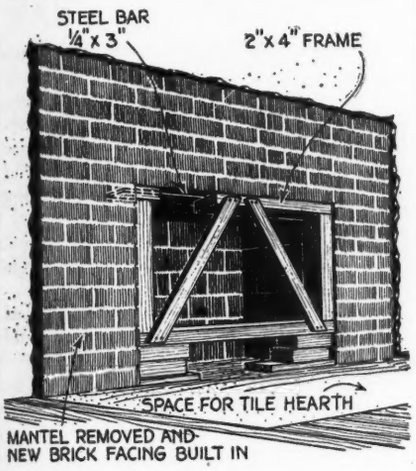
(Continued from page 98)

vertically at more or less frequent intervals.

The mortar seam should be ⅜ in. wide. Foresight is necessary to obtain a symmetrical line-up of brick and a sketch should be made beforehand, if the builder is uncertain on this point. The mortar joints should be "slicked" after three or four courses have been laid.

If a straight line opening is selected, the top should be supported with a piece of cold rolled steel ¼ by 2 or 3 in. and long enough to extend between the brick on each side of the arch about 10 in. It should be set back as far as possible from the front edge of the brick.

When the fireplace is completely faced with brick, a bed of three to one cement mortar should be prepared to receive the



The face bricks were built up over a frame and reinforced at opening with a steel bar

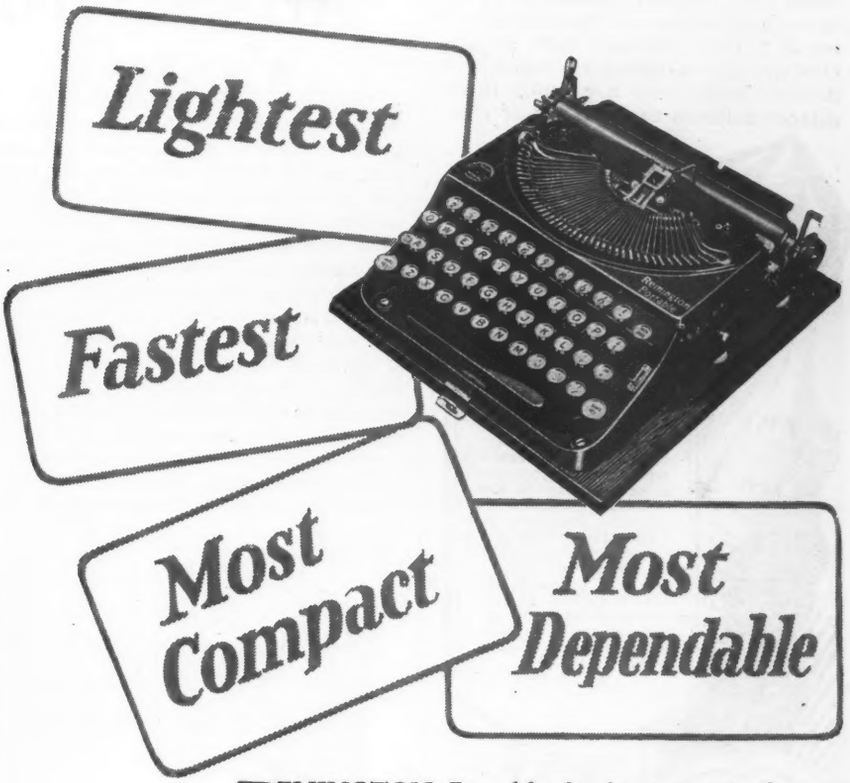
tile. The cement and sand should be mixed dry and then as little water as possible added. The mortar should be leveled carefully and built up to within ¾ in. of the expected height of the finished job. This will allow for a thickness of ½ in. for the tile and ¼ in. for the fresh mortar in which they are to be set.

For cementing the tile use a mixture of clear cement and water to which enough lime paste has been added to give a suitable consistency. The mixture should be just sticky enough to enable it to cling to the tile when held with the cement on the under side.

The space for the hearth should be measured and the allowable width of the cement joint computed, depending on whether 4¼ or 6-in. tiles are to be used. Spread a layer of cement on the bottom and edges of a tile and press it in place in one corner of the hearth. After three or four have been laid level them up, and as the work continues, check frequently.

When the mantel has been replaced and the brick and tile cleaned, rub the tile with a solution made of half linseed oil and half turpentine or gasoline. This will bring out their color. The tile should be allowed to set about forty-eight hours before being cleaned or walked on. A scrubbing with dilute hydrochloric acid will remove all traces of surplus cement.

Remington Portable



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It is the most compact of all writing machines—the carrying case is only 4 inches high. Years of service everywhere have proved its outstanding dependability under any and every condition of service. All these advantages—plus the standard keyboard!

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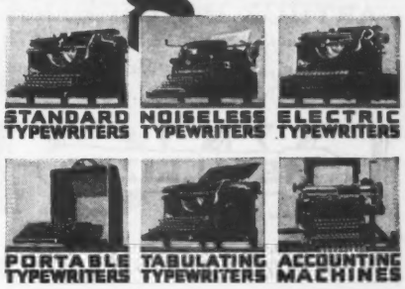

REMINGTON-MADE PARAGON RIBBONS AND RED SEAL CARBON PAPERS ALWAYS MAKE GOOD IMPRESSIONS

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The Home Workshop

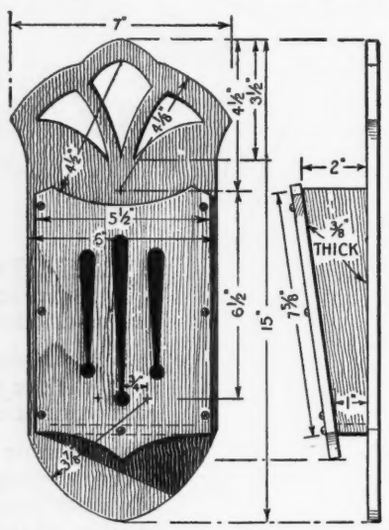
Artistic Wooden Mail Boxes

By W. W. WHITE

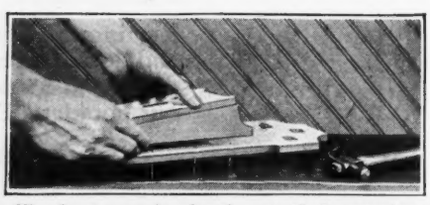
CHEAP tin letter boxes have little to recommend them. They are almost as out of place on a house as an old cigar box; the sheet metal soon becomes rusty and is also apt to cut the hands. Letter carriers, furthermore, do not like the usual type of box that has a lid, which is awkward to raise when one hand is occupied with a package of letters.

It is a simple matter to make an attractive wooden letter box. The architecture of the house should be considered in designing the box so that it will blend into the scheme of decoration without attracting undue attention, and the spot where it is to be hung also should be determined.

Dimensions that have proven satisfactory are shown in the accompanying drawing. One half of the design is drawn on a piece of paper, folded vertically on the center line, and cut out. This is used in laying out the wood, which should be soft and about ⅜ in. thick.



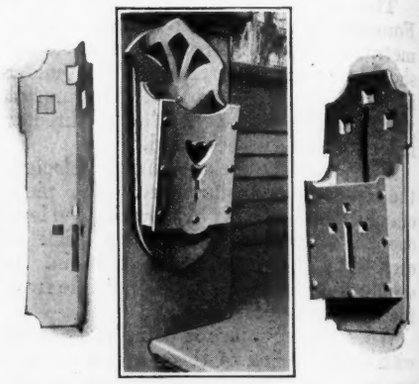
While there is much leeway in making this type of box, these dimensions have proved satisfactory



The front part is placed correctly by pressing it against nail points projecting through the back

The pierced work may be done with a coping saw. The sides may be laid out economically by marking them alongside each other, one with the 1-in. end up and the other with the 2-in. end up, so that a single cut will separate them.

In assembling, start the nails through from the back, allowing them to extend a short way. The front and sides, already nailed together, may then be pressed down on these nail points in their exact position. They will remain in position while the box is being turned on its face and the nails driven home.



Two types of attractive wooden letter boxes and the paper pattern for the back of one of them

If the nails through the front have been carefully spaced, the heads may be covered by driving upholstering tacks beside them. This adds a touch of beauty and saves the trouble of sinking and puttying the nail heads.

A pivoted lid, of course, may be added, if desired, and with a little ingenuity the box made relatively watertight.

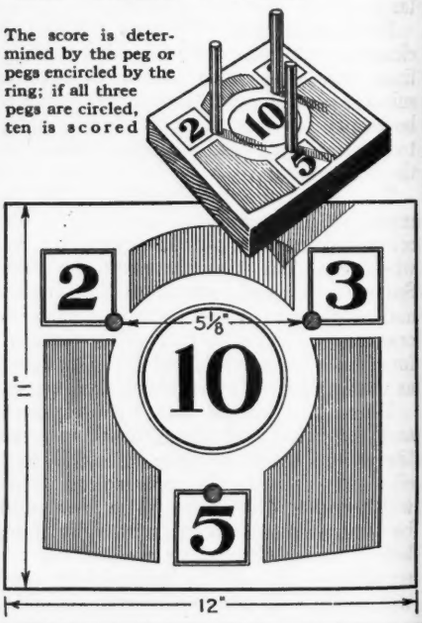
A strip of spring brass may be fastened near the top to provide a clip to hold outgoing mail.

The complete letter box should be painted either the body or trimming color of the house whenever possible.

How to Construct a Ring-Toss Game of Novel Design

RING games are always popular, and that illustrated below is more interesting than usual. The pegs are ½-in. dowels 5 in. high, set in a base ¾ by 11 by 12 in. The rings are 9 in. in diameter and may be rubber, light rope, or heavy cardboard.—DONALD W. CLARK.

The score is determined by the peg or pegs encircled by the ring; if all three pegs are circled, ten is scored



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The Home Workshop

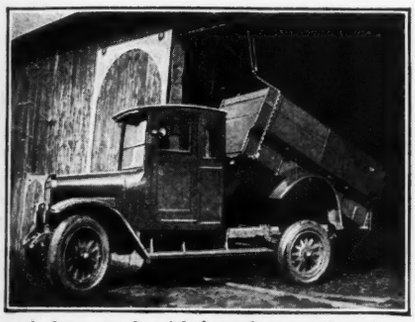
Dump Truck Saves Money for the Grain Farmer

By J. R. Koontz

HARDLY one out of ten of the trucks owned and operated by farmers is made so that the grain box can be dumped. The load must be scooped off—a long and back-breaking job. Yet a dumping-box can be made at small cost to fit any truck frame.

The chief reason the grain farmer makes a heavy investment in a motor-truck is so that he can haul the grain quickly to market when the price is right. But even with the use of the truck, the loading and unloading consume as much time as with the grain wagon method, unless you have a truck box that can be dumped. In most of the elevators, shipping stations and mills, there are hoisting devices for dumping the load.

The majority of trucks are so made that you can hinge the box to the rear end of



A farm truck with large homemade grain box that can be emptied quickly by dumping

the main frame. If your truck does not have a steel crosspiece at the rear, you will have to bolt a heavy iron piece across.

You will need a pair of very heavy hinges. These can be made from flat iron ⅜ in. or more in thickness and 2 or 3 in. in width. Cut four pieces 7 or 8 in. long, and have a ring bent at one end of each large enough to take a rod of ¾ or 1 in. round iron. Have two ½-in. holes drilled in the flat end of each of the four pieces.

Two of these pieces are fastened with ½-in. bolts to the rear bar of the main frame of the truck. The others are bolted to a crosspiece on the bottom of the truck box, as shown on the following page. Slip the round rod through the eyes of the four pieces and fasten it with a cotter pin through each end.

Have a piece of flat iron at least ½ in. thick and 3 in. wide bent to the shape indicated for the front end of the box. The length of this piece is determined by the width of the box. When the box is down on the frame all around, this piece must fit snugly in between the two side members of the main frame of the truck. It keeps the box in position when down, prevents it from slipping to one side or the other, and saves the hinges from undue side strains. The piece should be bolted securely to the bottom of the box 12 or 14 in. from the hinge. Another piece of iron of the same size must be made similarly to fit snugly in (*Continued on page 102*)

Why hadn't someone told him before?

HE understood at last—understood why he had been left alone so often—why his invitations had been refused. He knew now—but he could have been spared so many disappointments—so many lonely hours—if someone had only told him before.

A great many young men are inclined to have a grimy-looking skin spotted with blackheads and dull in appearance. Few realize that this hinders their success in life. Pompeian Massage Cream helps you overcome this handicap by giving you a clear, ruddy complexion.

Clears the Skin: Pompeian Massage Cream thoroughly cleanses the pores. It helps clear up blackheads and pimples by stimulating healthy circulation, and by keeping the skin clean and the pores open.

Easy to Use: After shaving or washing, rub the cream in gently. Continue rubbing and it rolls out, bringing with it all the dirt, grime, and skin impurities. Result—a clean, healthy skin with clear, glowing color.

Use Pompeian Massage Cream regularly at home—then you'll get the full benefit. At all druggists.

SPECIAL TRIAL OFFER

⅓ of a 60c jar—for only 10c

For 10c we send a special Trial Tube containing one-third of the contents of a regular 60c jar of Pompeian Massage Cream. Trial Tube contains sufficient cream for many delightful massages. Positively only one jar to a family on this exceptional offer.

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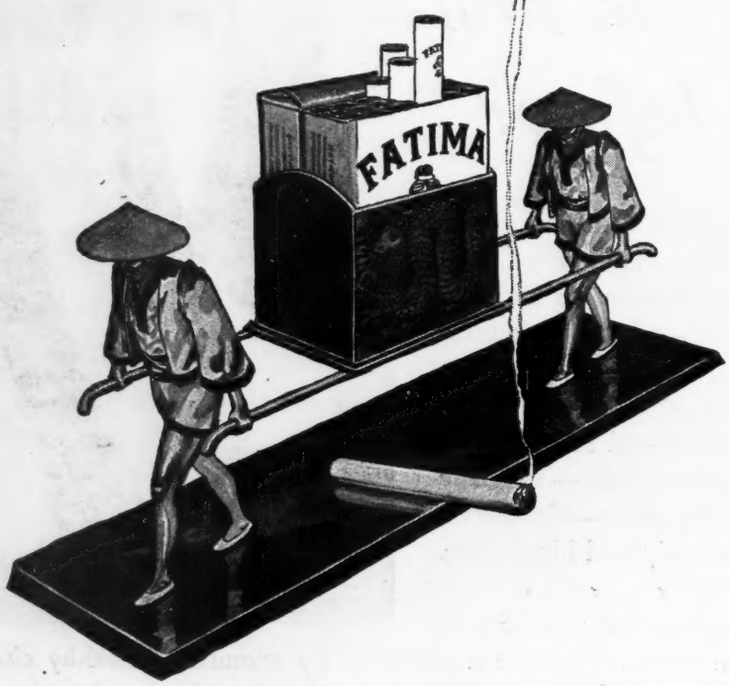

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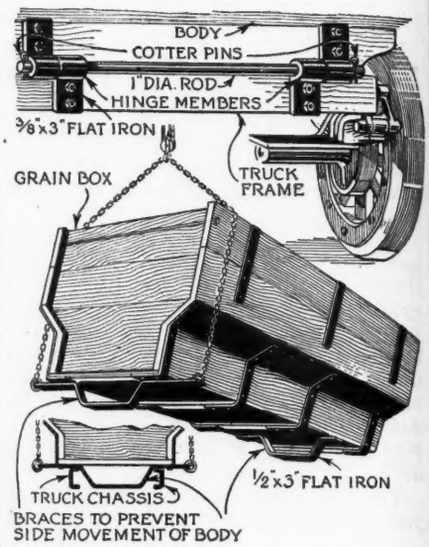
The Home Workshop

Dump Truck Saves Money

(*Continued from page 101*)



How the heavy flat-iron hinges and body braces are made for an ordinary motor truck

between the main frame 6 in. from the front end of the box. This piece should extend 2 in. beyond the lower end of the box on both sides. It should have three holes drilled in each end for ⅜-in. bolts. Place large washers under the heads of these bolts to prevent their pulling through the wood bottom of the box.

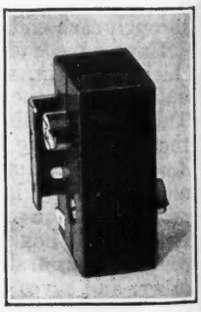
Within 1¼ in. of each end of the same piece, drill a ⅝-in. hole and have a ring of ½-in. round iron placed through each. Have the smith weld the rings together.

The bends in both these crosspieces should be at least 6 in. in depth if there is nothing on the frame to prevent them from going down that far. It is important, of course, to have the ironwork made of good material fully as large as described, and securely bolted, as the strain is considerable upon all members.

When unloading, simply hook the chains of the hoist into the rings of the bar at the front end and hoist the box.

If you live in a rough and hilly country, it would be best to fasten the front end of the box to the main frame by passing a chain through the rings on each side.

Marking Gage for Small Work



A SMALL marking gage for setting butt hinges and for delicate cabinet-making can be made as shown from a block 1½ by 2 by 3½ in., two 1½-in. lengths of ⅝-in. dowels, three sheet steel scriber points, an angular guide made from sheet-iron 1/16 by 1¾ by 2 in., and seven wood screws. One scriber point is fastened to each dowel and one is set into the block near the angular guide.—W. J. E.

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The Home Workshop

The Magic of Lacquering

(*Continued from page 68*)

seats of the chairs were given an extra good scrubbing, rinsed with the vinegar water, and set out in the sun to dry. Meanwhile we washed the floor, using as little water as possible, yet enough to do a good job and make sure that not a trace of dirt or grease remained.

Then I had Dan rub all rough spots on the chair frames with 00 sandpaper. After that he used a small, soft bristle pencil brush to apply the jade green lacquer to the metal cupboard catches, to which it stuck and flowed out smoothly.

THE same lacquer was applied to the old-fashioned china knobs of the kitchen doors. I was anxious to know how it would act on this kind of surface—one of the severest tests we could give a brushing lacquer—and later be able to study the wearing properties under the worst possible conditions. Nothing is harder on a finish than constant handling and contact with acid perspiration. The knobs, too, were covered easily and smoothly. Dan found that quick, circular strokes with a full brush were necessary for best results.

By this time the chairs were dry. After dusting them off carefully, I showed Dan how to turn a chair upside down and use a 1½-in. fitch brush to apply the pale ivory lacquer, using a stroke around the legs and stretchers and finishing each member completely before starting the next. Then we stood the chair upright and finished the cross slats. Last of all we applied a coat of rich brown lacquer to the woven seat.

By placing his hand, palm up, beneath the chair, Dan was able to lift it down from the table and set it out of the way without touching the fresh lacquer.

WHEN all of the chairs were lacquered with the pale ivory, I showed Dan how to use the ⅛-in. striping brush to run in the small green bands on the legs, and later he did the top knobs. Of course, he had to be very careful not to allow the green lacquer to lap over on the pale ivory. Everything had to look clean-cut and sharp.

When it came to lacquering the small breakfast room table, we laid some newspapers down on the kitchen worktable (made from a discarded office desk and previously refinished in enamel) and stood it up so that the leg frames could be done first in pale ivory lacquer, and the foot rail in a deep brown lacquer to match the chair seats.

This completed, the table was lifted down to the floor and the lacquer brushed on the short way of the top with a very wet brush and as few brushing motions as possible. Dan found that the best results were obtained by starting his first stroke parallel to the end of the table and working toward the edge in short strokes of 8 or 10 in. in such a manner that the brush was lifted off the wet surface at the end of each stroke, thereby avoiding any "stop mark" in the freshly applied lacquer.

(*Continued on page 104*)

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Rail Road 3¢ per mile
Street Car 2¢ per mile
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Down Comes the Cost of Travel!
Ride the New Way at 1¢ per Mile!
YOU save money every mile when you ride a Harley-Davidson Single — the new-type motorcycle that travels 80 miles on every gallon of gasoline.
Safe, comfortable traveling, too — and delightfully enjoyable. The Single is nearly self-balancing, with simple controls, responsive, powerful motor and 3-speed transmission.
Easier to ride and control than a bicycle — safe. Easy to park and house — any 2x8 ft. space will do. Easy to buy — your Dealer offers a convenient Pay-As-You-Ride Plan, and the price is low—complete with built-in electric equipment, f. o. b. Milwaukee, only $235
Safe
Almost self-balancing. Steering is instinctive. Simple controls—throttle and spark are in your hands all the time.
See your Dealer—and mail us the Coupon.
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Alice Higgie, a 13-year old Chicago girl, made $75.00 a week in vaudeville last summer. Her musical act is constantly in demand for clubs, lodges, hotels, radio studios and private entertainments. For a 15 minute act she receives $15.00—*a dollar a minute!* Read what she says—"Playing a musical instrument is lots of fun. I wish everybody knew how easy it is and how quickly you can learn, especially with Wurlitzer instruments—they are so easy to play."—Alice Higgie.

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WURLITZER

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The Home Workshop

The Magic of Lacquering

(*Continued from page 103*)

While we were at it, I touched up the handles of the worktable with jade green to bring it in harmony with the other furniture.

"This is the easiest type of refinishing I have done yet," remarked Dan. "It would be much harder if the furniture was badly cracked in places and there was a lot of patching to be done."

"Cracks and holes can be filled with putty," I said, "but the putty should be as free from oil as possible. A good combination is about one third white lead paste, or dry white lead, and two thirds whiting made into a stiff putty with japan drier. Such a putty will dry hard in a short time, which is most desirable, and will have a minimum amount of oil. A prepared lacquer putty can be obtained in some paint stores."

The kitchen floor was our next undertaking. I started the work in one corner, using a 3-in. brush full of gray lacquer.

"Don't cover a width of more than two or three boards" I told Dan, who was watching. "Apply the lacquer in the same direction as the boards run and brush from the unfinished to the fresh work, letting your brush lift up at the end of the stroke so as to 'feather out' the brush marks. Don't make any back and forth strokes at all, or the brush strokes will show."

DAN took the brush and soon had that side of the room done, after which I had him go over to the opposite half in order to "cut in" back and under the stove. With this done, he had a streak of 4 or 5 ft. down the center of the room, from the dining room door to the back porch entrance.

By starting at the dining room side of the room, Dan was able to work across the room to the outside door—a good way "not to paint oneself into a corner," as he expressed it.

"All done, mother," Dan finally reported to Mrs. McChesney.

"Well, if I had not seen it with my own eyes, I could never have believed it!" she exclaimed. "Tomorrow is Sunday, with my sister coming to dinner, and I can have my kitchen and floor spic and span. Why, bless me, these chairs are hard already! 'Tis a grand job you have, Mr. Waring, making things easier for us housekeepers. I believe any woman could do a good job with this lacquer. My, oh, my! Just think of the time it will save us, having our kitchen and chairs back in use so quickly."

And, judging by the quantity and quality of doughnuts she has since sent over to the laboratory, her delight in the appearance of her kitchen is going to last just as long as the beauty of the brush lacquered surfaces—at least, we hope so, for that will be a very long time indeed.

Another noteworthy article on finishing by Mr. Waring, who is a consulting chemical engineer, will appear in an early issue. Next month there will be an article on the ten questions paint dealers are asked most frequently.

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No. 15—Green gold, 17-Jewel Elgin Watch; 25-Year Quality Case; 12 Size; Gilt Dial. $30. $3 down and $1.00 a week.

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14-K white gold, hand engraved case. Fancy wing ends. Silver dial. High grade 15-Jewel movement. $25. $2.50 down and $1.00 a week.

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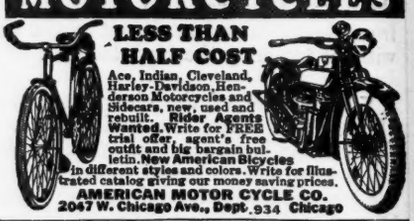

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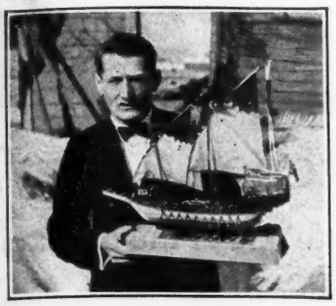
The Home Workshop

You, Too, Will Find It Easy to Build Models



THIS beautifully finished pirate galley was built by E. K. Brubaker, of Berlin, Pa., with the aid of Home Workshop Blueprints Nos. 44 and 45. It is one of many photographs sent in by readers who have made the POPULAR SCIENCE MONTHLY models.

Complete List of Blueprints

ANY ONE of the blueprints listed below can be obtained from POPULAR SCIENCE MONTHLY for 25 cents. The Editor will be glad to answer any specific questions relative to tools, material, or equipment.

Blueprint Service Dept.,
Popular Science Monthly,
250 Fourth Avenue, New York,

GENTLEMEN:

Send me the blueprint or blueprints, I have underlined below, for which I inclose.....cents.

No.	Title	Published	Price
1.	Sewing Table	Feb., '22	25c
2.	Smoking Cabinet	Mar., '22	25c
3.	End Table	Apr., '22	25c
5.	Kitchen Cabinet	May, '22	25c
8.	Shaving Cabinet	June, '22	25c
9.	Arbor, Gate and Seats	July, '22	25c
10.	Porch Swing	Aug., '22	25c
11.	Bench and Tilt Table	Sept., '22	25c
12.	Electric Washer	Oct., '22	25c
13.	Tea Wagon	Nov., '22	25c
14.	Christmas Toys	Dec., '22	25c
15.	Workshop Bench	Jan., '23	25c
16.	Inlaid Radio Cabinet	Feb., '23	25c
17.	Cedar Chest	Mar., '23	25c
18.	Phone Table and Stool	Mar., '23	25c
19.	Grandfather's Clock	Apr., '23	25c
20.	Flat Top Desk	Apr., '23	25c
21.	Colonial Desk	Apr., '23	25c
22.	Cabinet and Desk	Apr., '23	25c
23.	Pergola Garage	May, '23	25c
24.	Gateleg Table	June, '23	25c
25.	Canoe Sailing Outfit	July, '23	25c
26.	Baby's Crib and Pen	Sept., '23	25c
27.	Kitchen-Cabinet Table	Oct., '23	25c
28.	Pullman Play Table	Nov., '23	25c
29.	Toy Tea Cart, etc.	Dec., '23	25c
30.	Tool Cabinet, etc.	Jan., '24	25c
31.	Sewing Cabinets	Feb., '24	25c
32.	Chinese Game Table	Mar., '24	25c
33.	Dining Alcove	Apr., '24	25c
34.	Garden Trellises	May, '24	25c
35.	Simple Radio Cabinet	Oct., '24	25c
36.	Rush-Bottom Chair	Nov., '24	25c
37.	Simplified Bookcase	Dec., '24	25c
38.	Sheraton Table	Jan., '25	25c
39.	Salem Chest	Feb., '25	25c
40.	Desk in Sheraton Style	Mar., '25	25c
41.	One-Tube Radio Set	May, '25	25c
42.	Three-Stage Amplifier	June, '25	25c
43.	Four-Tube Receiver	July, '25	25c
44.	Pirate Ship Model—Hull	Feb., '26	25c
45.	Pirate Ship—Details	Mar., '26	25c
46.	Galleon Model—Hull	May, '26	25c
47.	Galleon Model—Details	May, '26	25c
48.	Sailing Yacht Model	July, '26	25c
49.	Broom Cabinet	Aug., '26	25c
50.	Airplane Model (Flying)	Sept., '26	25c

Name.....
(Please print name and address very clearly)

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City and State.....

THE DANGER OF NERVE EXHAUSTION

By PAUL von BOECKMANN

The high pressure, mile-a-minute life of to-day, with its mental strain, worry, anxiety, grief and trouble, is WRECKING THE NERVES of mankind. This applies especially to the people with highly active brains and sensitive nerves. Have Your Nerves stood the strain?

The symptoms of nerve exhaustion vary according to individual characteristics, but the development is usually as follows:

First Stage: Lack of energy and endurance; that "tired feeling."

Second Stage: Nervousness, restlessness, sleeplessness, irritability, decline in sex force; loss of hair; nervous indigestion, sour stomach, gas in bowels, constipation; irregular heart; high or low blood pressure; poor memory; lack of mental endurance; dizziness; headache; backache; neuritis, rheumatism, and other pains.

Third Stage: Serious mental disturbances; fear; undue worry; melancholia; dangerous organic disturbances; suicidal tendencies; and in extreme cases, insanity.

If only a few of the symptoms mentioned apply to you, especially those indicating mental turmoil, you may be sure your nerves are at fault—that you have exhausted your Nerve Force.

It is positive your nerves are at fault, if you feel generally depressed, tired and ailing, though repeated medical examinations fail to show definitely some organ is involved. In such cases the decline in organic power is due to subnormal nerve power.

I agree with the noted British authority on the nerves, Arthur T. Schofield, M.D., the author of numerous works on the subject, who states: "It is my belief that the greatest single factor in the maintenance of health is that the nerves be in order."

I am a *Nerve Specialist* and have treated more cases of "Nerves" than *any other man* in the world. My instruction is given by Mail only. No drugs or drastic treatments are employed. My method is remarkably simple, thoroughly scientific and invariably effective.

Submit your case to me, and I shall tell you definitely the exact nature of your weakness, and whether I can help *YOU*, as I have helped over 100,000 men and women during the last thirty years.

Positively no fee is charged for a "*Preliminary Diagnosis*" of your case, and you will be under no obligation to take my course of instruction, unless you wish to do so. Do not explain your case in your first letter, as I shall send you *special instructions* on how to report your case and how to make certain "nerve tests" used generally by Nerve Specialists. I shall also send you *FREE*, other important data on the subject which will give you an understanding of your nerves you never had before.

I have studied the health problem for more than 30 years from every angle. Far over a million of my various books on Health subjects have been sold all over the world during this time, and as a result about 300,000 people have written me in detail describing their weaknesses and experiences with different methods of treatment they applied. I am more convinced to-day, than ever before in my life, that nerve weakness (**Neurasthenia**), is the basic cause of nearly every ailment of civilized man and woman. Other weaknesses are simply the **result** of weak nerves. I have learned further, that worry, grief, anxiety, mental strain, and of course, sex abuse, are the basic cause of nerve weakness.

PAUL von BOECKMANN

Author of "Nerve Force" and various other books on Health, Psychology, Breathing, Hygiene and kindred subjects, many of which have been translated into foreign languages.

You should read my 64-page book, "NERVE FORCE." The cost of this book is only 25 cents (coin or stamps). The book is not an advertisement of any treatment I may have to offer. This is proved by the fact that large corporations have bought and are buying this book from me by the hundreds and thousands for circulation among their employees—Efficiency. Physicians recommend the book to their patients—Health. Ministers recommend it from the pulpit—Nerve Control, Happiness. Never before has so great a mass of valuable information been presented in so few words. It will enable you to understand your Nerves, your Mind, your Emotions, and your Body for the first time.

Read the book at my risk, that is, if it does not meet with your fullest expectations, I shall refund your money PLUS your outlay for postage. My advertisements have been appearing in this and other standard magazines for more than 20 years. This is ample evidence of my integrity and responsibility.

The following extracts are quoted from letters written by people who have read the book:

"I have gained 12 pounds since reading your book, and I feel so energetic. I had about given up hope of ever finding the cause of my low weight."

"I have been treated by a number of nerve specialists, and have traveled from country to country in an endeavor to restore my nerves to normal. Your little book has done more for me than all other methods combined."

"Your book did more for me for indigestion than two courses of dieting."

"My heart is now regular again and my nerves are fine. I thought I had heart trouble but it was simply a case of abused nerves. I have reread your books at least ten times."

Another writes: "Your book has helped my nerves wonderfully. I am sleeping so well and in the morning I feel so rested."

"The advice given in your book on relaxation and calming of nerves has cleared my brain. Before I was half dizzy all the time."

A physician says: "Your book shows you have scientific and profound knowledge of the nerves and nervous people. I am recommending your book to my patients."

A prominent lawyer in Ansonia, Conn., says, "Your book saved me from a nervous collapse, such as I had three years ago. I now sleep soundly and am gaining weight. I can again do a real day's work."

PAUL von BOECKMANN,
110 West 40th St., Studio 165, New York, N.Y.

Dear Sir: I desire to investigate your method, without obligation of any kind. (Print name and address plainly.)

Name.....

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Enclose 25c if you wish the book.

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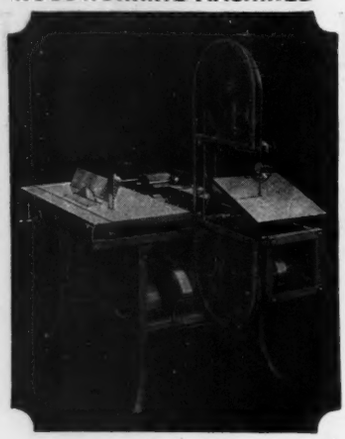

Cabinet Special $290 with Motor

See this PARKS this month!

September and October are "Parks Cabinet Shop Special months" with Parks dealers everywhere. In their showrooms this wonderfully popular woodworker will be on display and in many instances in actual operation.

Parks Cabinet Shop Special No. 10 at $290.00 is the handiest machine Parks ever built! Big enough to turn out first-class work—small enough to fit in a small shop or your basement—a real machine built for real work without freakish "stunt" designing. It makes practically any cut and includes rip and cut-off circular saw, jointer, and band saw. Lathe and shaper may be added at small extra cost. Every man who does cabinet making or woodworking of any kind wants this splendid machine. It is the biggest woodworking machinery value on the market today. Be sure to see this Parks this month *in these dealers' showroom*

ALA.: Moore, Handley Hdwe. Co., Birmingham; McGowin-Lyons Hdwe. & Supply Co., Mobile; Alabama Mchy. & Supply Co., Montgomery; ARK.: Ben D. Schaad Mchy. Co., Little Rock; CAL.: Shaw-Palmer & Bakewell Co., Los Angeles; Harron-Rickard & McCone Co., San Francisco; COLO.: H. W. Moore Equipment Co., Denver; CONN.: Lunt, Jillson Co., Manchester; FLA.: Cameron & Barkley Co., Jacksonville; Cameron & Barkley Co., Miami; Cameron & Barkley Co., Tampa; GA.: R. S. Armstrong & Bro. Co., Atlanta; ILL.: Woodworkers' Tool Works, Chicago; KY.: Roy C. Whayne Supply Co., Louisville; LA.: Clark D. Shaughnessy Co., New Orleans; MASS.: Lunt, Jillson Co., Boston; MICH.: Riverside Mchy. Depot, Detroit; McMullen Mchy. Co., Grand Rapids; MINN.: Raymer Hdwe. Co., St. Paul; MD.: Wm. Uhlhorn, Baltimore; MO.: Standard Tool & Supply Co., Kansas City; S. T. Hatcher Co., St. Louis; NEB.: Diehl Mchy. & Supply Co., Omaha; N. Y.: Interstate Mchy. Co., Troy; Chas. E. Mapps, New York City; N. H.: Brackett & Shaw Co., Somersworth; N. CAR.: Amer. Hdwe. & Equip. Co., Charlotte; Raleigh Iron Works Co., Raleigh; OHIO: J. C. Baker, Columbus; OKLA.: Universal Supply & Mchy. Co., Tulsa; ORE.: Portland Mchy. Co., Portland; PA.: K. O. Ditmars, Philadelphia; Coblentz Tool & Supply Co., Erie; S. CAR.: Cameron & Barkley Co., Charleston; TENN.: Peglar Mchy. Co., Chattanooga Iddins Mchy. Co., Knoxville; Harvill Supply Co., Nashville; Carriage & Wagon Supply Co., Memphis; TEX.: Universal Supply & Mchy. Co., Amarillo; Southern Implement Supply Co., Dallas, Don A. Carpenter & Co., El Paso; Peden Iron & Steel Co., Houston; Peden Iron & Steel Co., San Antonio; UTAH: Salt Lake Hdwe. Co., Salt Lake; VA.: James McGraw, Inc., Richmond; W. VA.: LaLance Equip. Co., Huntington; WIS.: Shadbolt & Boyd Co., Milwaukee; WASH.: Union Mchy. & Supply Co., Seattle; FOREIGN: Sipe Mchy. Agency, San Jose, Costa Rica; P. I. Zayas, Havana, Cuba; Weir Mchy. Co., Vancouver, B. C.; Morris, Black & Matheson, Ltd., Auckland, N. Z: West India Mchy. & Supply Co., San Juan; P. R.; Bourvinal & Co., Montreal, Can.; Engineering Supply Co. of Australia, Ltd., Brisbane, Australia.

See this Parks by all means! If you can't, then write us for circular No. 10 and the new Parks catalog.

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The Porter Chemical Co., 115 Summit Ave., Hagerstown, Md.

The Shipshape Home

Paint *Makes a* Kitchen *Cheerful*

How you can transform it into one of the brightest and pleasantest rooms in the house

By BERTON ELLIOT
Painting and Decorating Expert

"WE WANT to get some expert painting advice," said Mrs. Andrews, confidingly, as she and Mr. Andrews, neighbors of ours, seated themselves in comfortable chairs on our front porch.

"Well, what are you thinking of doing now?" I asked.

"It's the kitchen. My niece was out to our house the other day and told me how prettily they had fixed their kitchen. 'A perfect dream,' she said. I knew you could tell me how to make ours look as neat and pretty as any kitchen ever looked. John is going to do the heavy work, and I am going to do the bossing."

"A pleasant prospect for John!" I remarked, but, catching his eye, I could see he was reconciled to the undertaking and, apparently, as eager as Mrs. Andrews to find out the best way of decorating their kitchen.

"Well, let's see," I continued. "The woodwork in your kitchen is old-fashioned Georgia pine, isn't it? And the walls are in green paint your father put on several years ago.

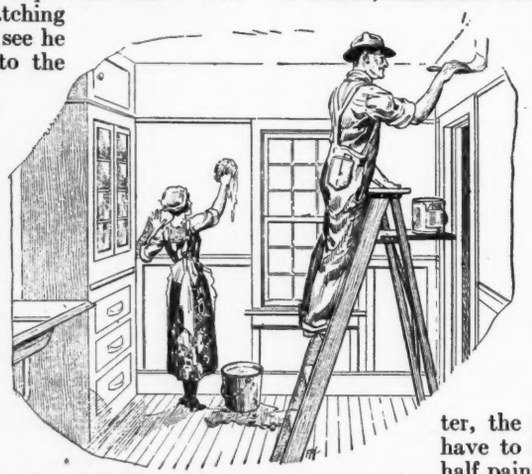
"Suppose you make the color scheme gray and yellow—gray enamel for the woodwork. This will be a most practical color and will not be nearly so hard to keep clean as white or the light ivories or creams sometimes used. And yellow enamel for the walls. We could do them in flat wall paint—but enamel, which dries to a porcelainlike smoothness, is so much less a dirt catcher, and can be so easily cleaned, that I am sure you will like it much better for the kitchen, where the walls are subjected to greasy fumes and deposits from cooking.

"We'll make the yellow a sunny shade bordering on buff, which will flood the room with cheer and sunshine—and do the woodwork in a two-tone effect; a neat, medium-dark shade for the wainscoting and the predominating color on doors and woodwork, trimmed with a lighter French gray. You'll have one of the prettiest effects you ever saw in a kitchen."

"That will be great," said Mrs. Andrews, as I paused momentarily.

"Now, as to the 'mechanics' of the job," I continued, "the first step is to wash the walls and woodwork thoroughly with soap and water. Then rinse with clear water to remove the soapy deposits. After this, go over the surface with a cloth saturated with kerosene, to cut any remaining grease, which is always a fatal enemy to good results in painting.

"You had better do the walls first, and, of course, commence with the ceiling and work down. The ceiling, by the way, should be the same color as the walls. Two coats should give you a good job. As the surface has previously been painted, it will not be necessary to use size in the first coat—but if it had been bare plaster, the first coat would have to be half size and half paint in order to seal the absorbent plaster. In case there are any cracks, they should be filled with patching plaster or a mixture of plaster of paris and paint.



Gray enamel for woodwork, yellow for walls

"The first coat should be half enamel and half undercoater or flat wall paint. Enamel is so transparent that the more solid covering paint is needed in the first coat to provide a suitable foundation for the final finishing coat. Forty-eight hours should be allowed for drying, and, if the job does not look first class after two coats have been applied, put on another one of full enamel.

"Don't be surprised if the enamel coat pulls hard under the brush. Enamel always works rather hard, but when applied with a small brush, as ordinarily used on woodwork or furniture, you don't notice it much. When put on with a big wall brush, however, you will get some good wrist exercise.

(*Continued on page 107*)

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

The Shipshape Home

Painting Your Kitchen

(*Continued from page 106*)

"When the walls are done, start the woodwork. Of course, you could first-coat the woodwork before you put the final coat on the wall, if you wished, and perhaps it would be better, as you wouldn't have to be so careful about daubing onto the walls.

"Having previously washed the woodwork, now sandpaper it with 0 or 00 sandpaper to cut the gloss of the old varnish coating. Then dust off loose sand particles. For the first coat, apply half enamel and half undercoater or flat wall paint of a gray color as nearly a match as you can get to the color of your gray enamel. Allow forty-eight hours for drying; then sandpaper and dust. Apply the next coat, straight enamel. Two coats should be enough for a gray enamel job, as you can do a colored job with less coats than if you were using more delicate and lighter tones.

"HOWEVER, if you do not get a good-looking finish with two coats on account of inexperience or unfavorable conditions of the surface, sandpaper the surface and apply another coat. And here is another thing to keep in mind. Let the wall paint dry thoroughly before starting any painting on the woodwork. Then if you daub any of the woodwork enamel onto the wall, it can easily be wiped off with a cloth saturated with gasoline, turpentine or benzine.

"For the trim color, lighten some of the gray enamel with white—either oil color or white enamel. Or you might find just the shade of French gray you want for the trim tone, and darken a batch for the darker shade with lampblack oil color or black enamel.

"You will need a four-inch wall brush for the walls, and about a two and a half-inch enamel brush for the woodwork. It might also pay to have a half-inch brush for getting into corners and small places, doing the edge of the woodwork where it joins the wall, doing the trim tone, and the like. An experienced painter would not need this little brush, but one is a big help to the amateur painter. And that's really about all there is to it, Mrs. Andrews."

"I think it will be a very interesting undertaking," she replied, radiant with enthusiasm.

"YES, but you may feel discouraged about the time you are half through with the first coat. First-coat work by the inexperienced, especially over previously varnished woodwork, usually looks 'terrible.' But after the first coat, you will steadily see the room grow more beautiful as you go along, and your interest will be unbounded. You will probably find it takes three coats, but your personal interest and carefulness will offset the painter's experience, and you will have a real job when you get through.

"And then there are the pipes, the under part of the sink, and so on. Of course, they can always be finished with aluminum paint (*Continued on page 108*)

The Telephone and the Farm

THERE was not a farmer in the world fifty years ago who could talk even to his nearest neighbor by telephone. Not one who could telephone to the doctor in case of sickness or accident. Not one who could telephone for the weather report or call the city for the latest quotations on his crops. Not one who could sell what he raised or buy what he needed by telephone. A neighborly chat over the wire was an impossibility for the farmer's wife or children.

In this country the telephone has transformed the life of the farm.

It has banished the loneliness which in the past so discouraged the rural population and drove many from the large and solitary areas of farms and ranches.

It is a farm hand who stays on the job and is ready to work twenty-four hours every day.

The telephone has become the farmer's watchman in times of emergency.

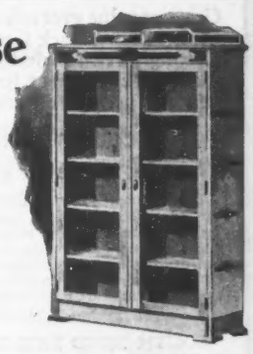
It outruns the fastest forest or prairie fires and warns of their approach. It has saved rural communities from untold loss of lives and property by giving ample notice of devastating floods. Three million telephones are now in service on the farms, ranches and plantations of the United States.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY
AND ASSOCIATED COMPANIES

BELL SYSTEM

IN ITS SEMI-CENTENNIAL YEAR THE BELL SYSTEM LOOKS FORWARD TO CONTINUED PROGRESS IN TELEPHONE COMMUNICATION

An *Easy-to-build* Bookcase



IF YOU have not had much experience in woodwork, you will find the bookcase illustrated one of the few really attractive and useful pieces of furniture that you can construct without a single difficult joint. The parts are put together with butt joints such as are used in making common boxes; there is not a dowel, a mortise and tenon, nor a dovetail used in the construction.

The unique methods by which the construction has been simplified are not apparent, however, in the finished bookcase. The design is good and will stand comparison with the better class of bookcases sold in furniture stores.

Blueprint (No. 37) of the bookcase will be sent on receipt of 25c.

POPULAR SCIENCE MONTHLY, 250 Fourth Ave., NEW YORK

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

If your hair won't "lie down"

keep it in place with the dressing more fellows use than any other . . .

Almost every fellow uses *something* to keep his hair from getting out of place.

Maybe he plasters it down with water. In that case he is robbing his hair and scalp of their natural oils, making them an easy prey to dandruff.

Or perhaps he relies on sticky preparations that leave the hair matted and greasy-looking.

But that isn't necessary today! You can start now to use the hair dressing that is relied on by more fellows than any other! *This dressing is Stacomb.*

No matter how you wear your hair, Stacomb will keep it in place—smooth, slightly glossy—*all day long.*

Yet never gummy or greasy-looking. Stacomb is actually beneficial, because it helps to prevent dandruff.

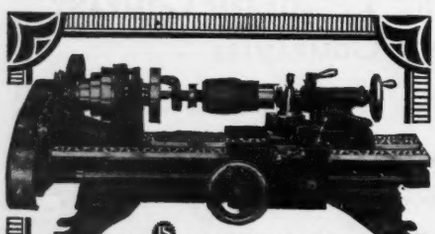
And whether you prefer the combing cream (in jars and tubes) or the new Liquid Stacomb, you will find that both forms are equally pleasant to use and either one will *really keep your hair in place.* At all drug and department stores.

FREE OFFER— Stacomb

Standard Laboratories, Inc.,
Dept. BC-1, 113 W. 18th Street, New York
Send me free sample of Stacomb as checked:
Original, cream form ☐ New liquid form ☐

Name.....

Address.....



IS

New 9-Inch Bench Lathe $150

Easy Payments If Desired

Greatest value ever offered in a fine quality Lathe. Back Geared, Screw Cutting. Price includes Countershaft and Equipment. Just what you need for general all-around work.

Especially Suited for Garage Work

With this small practical Bench Lathe, you can turn Commutators, undercut Mica, make bronze Bushings, reface Valves, machine Pistons, cut threads, do turning, boring, drilling, filing, polishing and hundreds of other jobs. It is the newest number of the complete line of South Bend Lathes.

Write for Free Folder No. 22-B

SOUTH BEND LATHE WORKS
826 E. Madison St., South Bend, Ind.

The Shipshape Home

Painting Your Kitchen

(*Continued from page 107*)

and look quite all right. But, located as they are in your case next to the wall, I think you would like them better if done in the yellow wall color. You can paint them with the same material you put on the walls—a couple of coats.

"The under part of the sink would probably look a little better in white, but it is almost out of sight anyway, and either the gray or yellow enamel would look very well. Regular enamel undercoater or flat wall paint can be used satisfactorily on metal surfaces, followed by a finishing coat of either flat wall paint or enamel in the desired color.

"Bread box, coffee, tea, sugar and spice boxes can be done in yellow enamel, decorated with transfer or stencil designs. Broom, brush and dustless mop handles, as well as dustpan and crumb tray, can also be done in the same color scheme. That shelf in the corner can be utilized for a bowl of yellow flowers, or a yellow flowering plant. Curtains in ecru, or in white with yellow checked gingham drapes and valance will tone in with the scheme. You'll think of some other things, too, as you go along.

"You'll find, when you are through, that the kitchen is the most interesting room in the house, and you'll want to go ahead and do some of the other rooms."

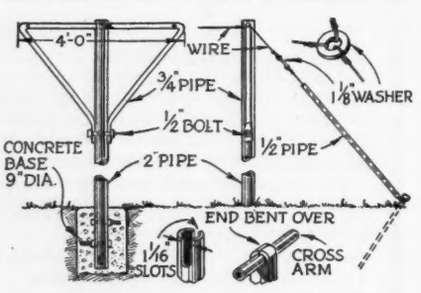
Iron Post for Clothesline

How a clothesline support of the utmost durability can be made is shown in the accompanying illustrations. The scrap piles of any power plant or plumbing shop will furnish the material.

A rigid and durable clothesline support

The stand itself is an old boiler flue — a piece of 2-in. pipe will do just as well. The top arm is a ¾-in. gas pipe. The gas torch of any garage can be used in forming the bends and doing the upsetting.

Nothing short of an armored war tank will disturb the posts when once the concrete has hardened.—F. W. Bentley, Jr.



Front and side views of support, and details showing cross arm joint and stay spreader

Millions of Motorists Now Fix Punctures This New Simple Way

Nothing Else Like It

Motorists by the millions are discarding the old-fashioned way of fixing punctures with temporary cold patches for a newer, simpler way.

It is called the Shaler 5-Minute Vulcanizer. This handy little outfit makes permanent heat-welded (vulcanized) tube repairs in just a few minutes.

Motorists use it, not because they like to fix punctures, but because it's the easiest and quickest way in an emergency.

Anyone Can Do It

Simply clamp a Shaler Patch-&-Heat Unit over the puncture and light the prepared solid fuel it contains. In five minutes take off the pan and throw it away. That's all. The repair is permanent because it's heat-welded (*Vulcanized*) to the tube.

Get it today for only $1.50 wherever auto supplies are sold. Slightly higher in Canada and far West. Outfit includes vulcanizer and 12 Patch-&-Heat Units—ready for instant use.

C. A. SHALER CO., Waupun, Wis. U.S.A.

SHALER

5-MINUTE VULCANIZER

A Handy Small Table

Would you like to own this combination end table and book trough? Bought in a store this end table would cost $20 to $25. If you make it yourself it will cost you only $5 or so for the hardwood, and the finishing materials.

If you can use a hammer and saw you can easily make this handy table from Home Workshop Blueprint No. 3 which will be sent you on receipt of 25c. Blueprints are mailed the day order is received.

POPULAR SCIENCE MONTHLY
250 Fourth Avenue New York

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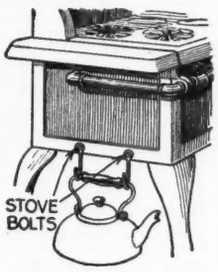
The Shipshape Home

Holder for Teakettle

THERE are times when a teakettle is in the way on the top of a small stove. To provide a convenient place where it can be put, even when hot and full of boiling water, a holder may be bolted to the stove as shown. It is necessary merely to drill two holes through the iron band that forms the skirt or frame of most gas stoves. The holes should be about 4½ in. apart.



The holder attached to the end of a gas stove

Two pieces of steel wire 3/32 in. in diameter and 7 in. long are formed with a ¼-in. eye on one end and a good sized hook on the other to receive the kettle handles. These are fastened to the stove with stove bolts.—C. D. P.

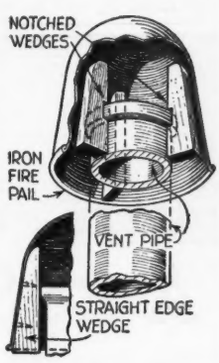
Puttying Windows

TO MAKE a neater job in puttying windows, I cut a small groove in my putty knife about half an inch from one corner, as shown. This groove rides in the corners of the wood, while the point of the blade rests on the glass. When pushed down hard, the knife will not slip and a straight line of putty is insured.—STEPHEN J. HOUBRICH.

The notch guides the putty knife straight

Wind Cap for Plumbing Vent

DURING very windy weather a down draft was created in the bathroom vent pipe. To remedy this unpleasant condition, the handle was removed from an old, round-bottom fire pail. This was fastened over the vent by means of three wooden blocks cut to fit the taper in the pail. Two of the blocks were notched to fit a flange at the top of the vent pipe and were screwed inside the pail 120 degrees apart. At the same time two holes were drilled in the pail for attaching the third block, which was pushed into place and fastened after the cap had been set over the vent pipe. The three wedges hold the pail as firmly as if it were part of the pipe.—C. D. PATERSON.



Three wedges hold the pail rigidly in place

You'll be proud to own both

SARGENT planes will contribute not only to the pride you take in owning and using good tools—but to the improvement of your work as well. These are good planes—two of the finest money will buy. And the two which will fill practically every need you will ever have for finishing tools. Yet they are not expensive by any means—costing less than you would expect to pay for such planes.

Get them without delay.

You'll be more than pleased with the way they cut, with their simplicity of adjustment, and with their edge-holding cutters of durable chromium steel. Sargent Auto-Set has an exclusive feature—time and trouble saving—which your hardware dealer will be glad to show you. The steel block plane is the handiest little plane you ever saw. Look for the Sargent trade-mark. It is a guarantee of excellence and long life in planes.

SARGENT & CO., *Manufacturers*, 50 Water St., New Haven, Conn.

Sargent Steel Block Plane No. 5206

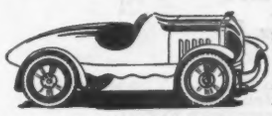
Sargent Auto-Set Bench Plane No. 714

IS

SARGENT
PLANES

TOOL CHESTS
FOR PARTICULAR MEN
Toolmakers and Machinists will find the right Case in our
FREE CATALOG
Send for it TO-DAY.
H. GERSTNER & SONS
533 Columbia St., Dayton, O.

SPORT BODIES for FORDS
at FACTORY PRICES!

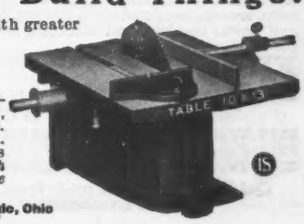

This Model in Grey Prime **$39.50**
Write for Booklet A-10 Showing Other Models.
SPORT FACTORIES, Aurora, Illinois

Making It Easy to Build Things!

You can perform every woodworking operation with greater speed, accuracy and economy on

Boice-Crane Bench Band Saws

Do ripping, mitering, grooving, rabbeting, sanding, grinding and band saw operations better, quicker and easier. Driven by any ¼ to ½ h. p. motor; portable; attached to any light socket. Sold with or without motor. Unsurpassed values and prices. *Write today for 64-page booklet on Bench Saws, Drills, Jointers, Lathes, Band Saws and the Boice E-Z Pay Plan.*



IS

W. B. & J. E. Boice. Dept. P. S. 9-B Toledo, Ohio
"World's Largest Makers of Small Bench Machines"

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Unsightly holes easily patched-

with this new patching plaster

AND the patch will *stay*. Rutland Patching Plaster will not shrink as plaster of paris shrinks. It does not dry or "set" instantly like plaster of paris—hence is easy for anyone to use. It will not crack, crumble or fall out.

You can paint or paper over it without shellacking and the patch will not "spot" through. The handy cartons come all ready to use. Just add water.

Paint, wall-paper, and hardware stores sell Rutland Patching Plaster. If your dealer hasn't it, mail coupon. We will send you a 2½ lb. carton and you can pay the postman 30c plus postage upon delivery. Rutland Fire Clay Co., Dept. R4, Rutland, Vermont.

A few of its many other uses

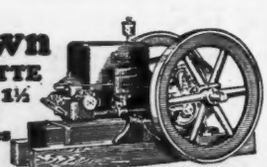
Mending outside stucco or cement walls.
Pointing brick work.
Closing mouse or rat holes.
Sealing small cracks where insects or vermin enter.
As a mortar to hold loose tiles in bathroom walls or floors.

Rutland
Patching Plaster

RUTLAND FIRE CLAY CO.
Dept. R4, Rutland, Vermont
Send me 2½ lb. carton of Rutland Plaster.
Name .....
Address .....
.....
My Dealer's Name .....

$5 Down

Buys Any WITTE Engine From 1½ to 7 H-P.—No Interest Charges



The Ideal Farm Engine for Pumping and All Farm Chores. **The One-Profit Engine—Sold Direct To You From Factory On Your Own Terms.**

Develops Full Power on KEROSENE, GAS-OIL, GASOLINE, DISTILLATE or GAS. Simple economical and trouble-proof. Equipped with WICO Magneto, square, protected tank, die-cast bearings, speed and power regulator and throttling governor. ALL SIZES 1½ to 30 H-P.

FREE Write today for big, Free Catalog and Low Prices. Or, if interested, ask about Log and Tree Saws, 3-in-1 Saw Rigs or Pump Outfits.

WITTE ENGINE WORKS
2221 Witte Building, KANSAS CITY, MO.
2221 Empire Bldg., PITTSBURGH, PA.
2221 Witte Bldg., SAN FRANCISCO, CAL.

Quick shipments also made from nearest of 25 warehouses.

The Home Workshop

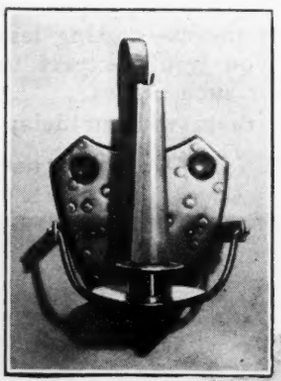
Few Tools Needed to Make Distinctive Candlesticks

By Rufus E. Deering

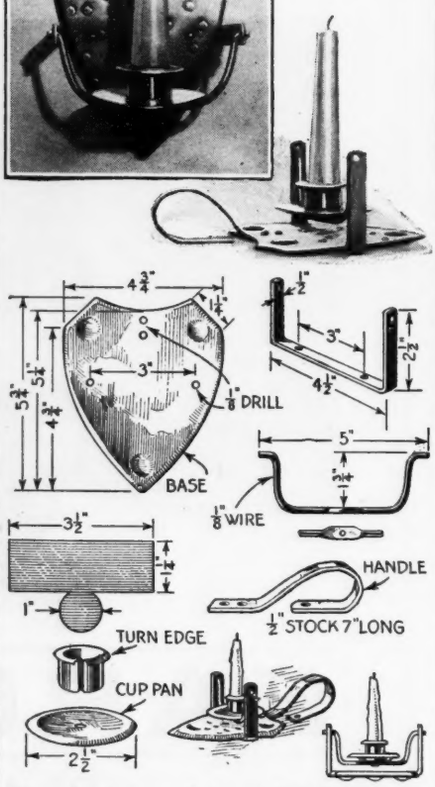
DECORATIVE candlesticks, either for gift purposes or for your own home, can be made with little difficulty from soft sheet iron with a few common household tools.

The distinguishing characteristic of the design illustrated is that the candlestick either may be used as a table ornament or hung on the wall.

The base is in the shape of a shield of the dimensions indicated on the drawing.



This candlestick serves as a distinctive wall sconce or as a table ornament. The details are shown below



The edge is turned down slightly by hammering it over the corner of an anvil or iron block. Feet are formed at the three corners simply by stamping round depressions in the metal with the rounded end of a bolt. Hold the base on a piece of soft wood when forming the depression.

The handle and the support for the candle cup are made from ½-in.-wide iron strips. If they are beaten with a ball-peen hammer so as to show the marks, they will have a more artistic appearance.

The swinging support for the candle cup is a length of ⅛-in. soft iron wire. The candle cup and the cup pan are made from flat pieces of soft iron. The assembled fixture should be smoothed with emery cloth and then lacquered in its natural color or stained and lacquered.

Imperial Sanitary Floor

Put on like Plaster
Wears like Iron
-waterproof
-fireproof
-resilient
-noiseless
-dust-less
Base and Floor one solid piece

A composition material easily applied in plastic form over practically any kind of floor. Laid about ⅜ inch thick. Imperial Floor does not crack, peel or come loose from foundation. A continuous, fine grained, smooth, non-slipping surface. No crevices to gather grease, dirt, dust, disease germs or moisture.

Ideal Floor for Kitchen, Pantry, Bath Room, Laundry, Porch, Garage, Restaurant, Theater, Hotel, Factory, Office Building, Railroad Station, Hospital—wherever a beautiful, substantial floor is desired. Several practical colors. Full information and sample FREE of your first and second choice of color.

Imperial Floor Co., 62-66 Halstead St., Rochester, N. Y.

A Success for 15 Years

Stop Using a Truss

Reduced Fac-Simile Gold Medal

STUART'S PLAPAO-PADS are different from the truss, being mechanico-chemico applicators made self-adhesive purposely to hold the distended muscles securely in place. No straps, buckles or spring attached—cannot slip, so cannot chafe or press against the pubic bone. Thousands have successfully treated themselves at home without hindrance from work—most obstinate cases conquered.

Reduced Fac-Simile Grand Prix

Soft as velvet—easy to apply—inexpensive. Awarded Gold Medal and Grand Prix. Process of recovery is natural, so afterwards no further use for trusses. We prove it by sending Trial of Plapao absolutely FREE. Write name on Coupon and send TODAY.

Plapao Co., 1313 Stuart Bldg., St. Louis Mo.

Name .....
Address .....
Return mail will bring Free Trial Plapao

BLANK CARTRIDGE PISTOL

Protection Against Burglars, Tramps and Dogs

PRICES 50c. $1.00 POST-PAID

Well made and effective; modeled on latest type of Revolver; appearance alone is enough to scare a burglar. When loaded it may be as effective as a real revolver without danger to life. It takes standard .22 Cal. Blank Cartridges obtainable everywhere. Price 50c. Superior quality $1.00 Postpaid. Blank Cartridges, by express, 50c per 100.

Johnson Smith & Co. Dept. 566, Racine, Wis.

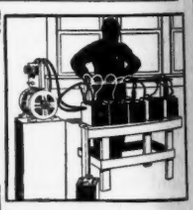
Skin Troubles

Cleared Up—often in 24 hours. To prove you can be rid of pimples, blackheads, acne eruptions on the face or body, barbers' itch, eczema, enlarged pores, oily or shiny skin, simply send me your name and address today—no cost—no obligation. CLEAR-TONE tried and tested in over 100,000 cases—used like toilet water—is simply magical in prompt results. You can repay the favor by telling your friends; if not, the loss is mine. WRITE TODAY.

E. S. GIVENS, 458 Chemical Bldg., Kansas City, Mo.

ONE DAY BATTERY CHARGING PAYS BIG

Charge batteries in 1-3 the time required by others and get the business. Latest method recommended by the leading battery companies and approved by the U. S. Bureau of Standards. BIG YEAR ROUND PROFITS. Best paying business in automotive field. Requires no special experience, uses small space. 30 days free trial at our risk under absolute money back guarantee. Write today for Bulletin X, giving full particulars. HOBART BROS. CO., Box P9, TROY, OHIO.



ONLY $16.50 MONTHLY

A 2c Stamp

—will start you on the road to success. See Money Making Opportunities on pages 118 to 143.

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The Home Workshop

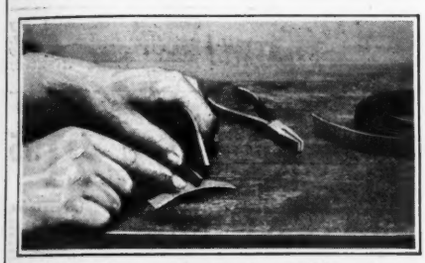
It's Easy to Magnetize a Piece of Steel

IN ORDER to make a steel magnet, various methods may be employed. If a magnet is already at hand, the piece of steel to be magnetized need only be rubbed with it. This is the mechanical way.

Place the steel flat and, beginning in the center, rub the magnet on the steel toward one end, as illustrated. Lift the magnet, place on the center of the steel and rub again. Do this about ten times. Then take the other pole of the magnet, that is, the opposite side of the horseshoe, and rub the other half of the steel in the same way. Repeat this process until the steel has become sufficiently magnetic.

Almost any type of steel can be used. Part of an old spring is excellent, especially if the resulting magnet is to be used in current indicating devices such as voltmeters, ammeters, or galvanometers. Compass pointers of any size may be made in this way.

Another very simple way of magnetizing a bar of steel is with the aid of a dry



Magnetizing a strip of spring steel by stroking it with a permanent horseshoe magnet

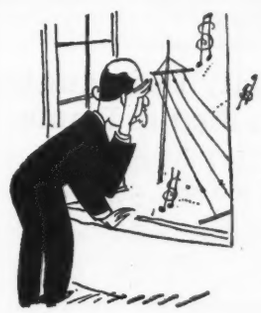
cell battery, storage battery, or any type of wet battery, giving about six volts.

Shape the metal and then wind a piece of string over the steel for about one third of its length at each end. Over this place a piece of paper. Now take some double cotton covered wire such as is used for radio, any gage from 22 to 28, and wind four layers at each end. The length of each coil should not exceed one fifth the length of the steel.

Both coils are made from one length of wire. If it is a bar, the windings go in the same direction; if a horseshoe, the windings go in the same direction, but that requires the first coil to be wound in one direction and the other coil in the opposite way.

Cover the turns with melted paraffin or wax; at the same time use sufficient wax to hold the coil in place on a board, if the metal is bent into a horseshoe. Remove the string so that the coils will slip easily along the metal.

Connecting one end of the wire to the battery, insert the steel in the coils, close the circuit, and very slowly push the metal into the coils as far as the center of the metal. It makes no difference, of course, whether the coils or steel is moved. Open the circuit, that is, disconnect one terminal from the battery, and take the metal out of the coil. Repeat the process thirty or forty times. By that time the steel will have all the magnetism it can retain.—H. E. B.



There's a golden tinkle in the air—

Does it reach your ears? All you need is a Rectigon to make music sound like money. And to keep your batteries charged up to their ears with pep. Thus you attain best possible reception at lowest possible cost. Your Rectigon pays dividends quickly in money saved from the service station. And you always have a marvelous power reserve to bring in the best your set can get.

and it comes from charging at home with

The Westinghouse Rectigon Battery Charger

©, 1926, W.E.&M.Co.

No Noise as it Charges
—not a bit of fuss. Not even a murmur that would disturb the mildest slumber.

No Acids, no Chemicals
—no moving parts—nothing to spill or burn. No muss, nor worry. You'll have no spoiled rugs, ruined clothing.

Snaps On in an Instant
—just plug into the light socket, snap on the terminals. Saves service station bother. Spares interruptions caused by absent batteries.

Charges Both "A" and "B" Batteries
—keeps both packed with power. Bulb is used for "B" battery charging and it is enclosed, like all other parts, in metal, safe from accident. (Rectigon charges automobile batteries, too.)

Safety for Batteries and Set
—you'll not wake to find your battery discharged — that can't happen with a Rectigon attached. Should you tune in without detaching the Rectigon from battery, your set won't be harmed.

THE RECTIGON is a superb Westinghouse product. Things you *can't* see, like extra heavy insulation, things you *can* see, like the durably enameled case—all are of highest quality. Westinghouse manufactures also a complete line of radio instruments, and Micarta panels and tubes.

WESTINGHOUSE ELECTRIC & MANUFACTURING CO.
Tune in on KDKA - KYW - WBZ - KFKX

No Storage Battery Radio is Complete Without a Rectigon

CARTER

"HI-OHM" Universal Volume Control

$2 Half Size

Same size and general construction as famous Carter "IMP" Rheostat. All metal — no moulded parts to crack or break. Smooth, silent contact. Same in potentiometer form—Carter "HI-POT".....$2.25
Any dealer can supply

In Canada: Carter Radio Co., Limited, Toronto

Carter Radio Co.
300 S. RACINE AVENUE
CHICAGO, ILL., U.S.A.

Absolutely Guaranteed

WADE BENCH LATHE

For Repair Shops, Amateur Mechanics, Model Makers, Inventors who want a real, *accurate* machine tool at a price within easy reach. *A complete shop in itself.* Capacity 4 in. diameter x 12 in. length. Handles metal, wood, and other materials. Turning -- facing -- boring -- drilling--winding--thread cutting. The "Wade" is a bargain at several times the price. Guaranteed a high degree of accuracy, quality of materials, workmanship and finish.

The slidecrest has travel entire length of bed. Leadscrew inside bed. Hollow spindle.

No. 1 Lathe, plain headstock - - $28.00
No. 2 Lathe, back-geared - - - 38.00

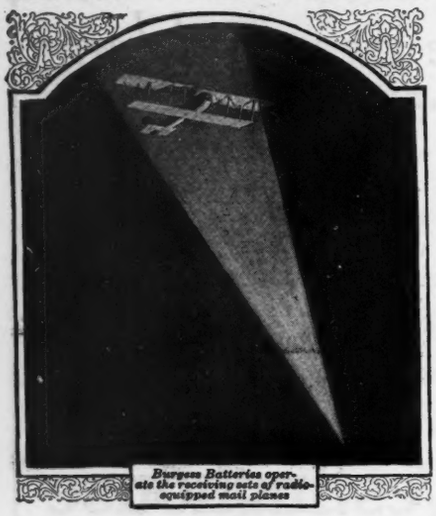
Either lathe with 18 in. length between centers, $7.00 extra. Complete line of accessories. By all means write for this free book.

THE GEROLD COMPANY
Dept. PS-13, 120 Liberty St., New York

WADE

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

ASK . . ANY . . RADIO . . ENGINEER



Burgess Batteries operate the receiving sets of radio-equipped mail planes

An every-night adventure of Burgess Radio Batteries

ONE of the reasons why you should always buy Burgess Radio Batteries is that the batteries used by air-mail pilots—battleships—explorers—and the majority of recognized radio engineers—are evolved in the Burgess Laboratories and manufactured in the Burgess factory.

These batteries are identical with the batteries sold by your dealer and thousands of other good dealers everywhere.

BURGESS BATTERY COMPANY
GENERAL SALES OFFICE: CHICAGO
Canadian Factories and Offices:
Niagara Falls and Winnipeg

BURGESS RADIO BATTERIES

The Home Workshop

Simplicity Distinguishes This Picture Frame

By H. J. MACDONALD
New York Military Academy

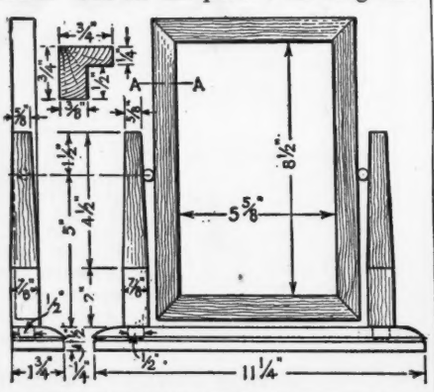
FEW tools are needed to make the standing picture frame illustrated.

After the base, which is ¾ by 1¾ by 11¼ in., is squared to size, mark out the mortises for the posts. With the marking gage draw a line around the front and both ends, ½ in. from the top. Then run a small three-cornered file over the groove until you have a three-cornered groove about ⅛ in. deep.

An excellent frame for photos or colored prints

Draw a line ¾ in. from the front and ends on the top of the base with a pencil. Place the base in a vise and with a half sheet of No. 1 sandpaper torn lengthwise, sand the curve, by holding the sandpaper in both hands and pulling it across the wood with a rolling motion. Do the same at the ends. Then finish with No. 00 sandpaper. Be sure that the front curve meets the end one at 45 degrees.

The posts may be made at once out of a piece ⅞ in. square and 14½ in. long. After the ends have been squared, mark a line all around 4½ in. from each end. On each end, using a marking gage, draw a ⅝-in. square and run the lines to the 4½-in. line. Then plane down to them. Cut off the posts 7 in. long and



Working details of the stand. The frame can be made from any molding of simple design

cut a ½-in. tenon at the ends. Finally cut the mortises in the base.

The frame may be purchased or made from picture frame molding about ¾ in. square, which can either be bought or made. A 3-ft. length will be required. The corners are cut at a miter and glued and nailed.

The decorative beads on the swivels are made from ⅜-in. square stock. First drill the hole to fit a No. 4 screw and then make each piece round in the hand with sandpaper. The frame swivels on a 1-in. No. 4 flathead screw, which is countersunk in the post and goes through the rabbet of the frame.

SW

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THESE are the GENUINE French and German Army Officers' 8-POWER PRISM Binoculars; famous PREMIERE QUALITE; brand new, *PERFECT*. Brilliant illumination, exquisite definition. Wide field of vision—many times area of field glasses. Central focusing with individual eye-strength and width adjustments. Leather case, neck and shoulder straps. Usually sell for $40 to $50.00. Advantageous foreign exchange rates make possible Bargain price **$23.50**

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Clip and mail this Adv. NOW. Please tell us something about yourself. We will appreciate and respect the information. THANK YOU. P.S. 9-26

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this easy fingering Buescher Saxophone. Most wonderful music. 3 lessons given on request with each new Buescher True-Tone. Teach yourself. Many play scales right off—easy tunes first week. You can.

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Try any Buescher Instrument for 6 days. Satisfaction or no sale. Easy terms arranged. Send postal for catalog and details of trial and payment plans. Mention instrument preferred. No obligation. Send today.

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This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS, See page 6.

The Home Workshop

Novel Cigarette Holders Cut from Thin Wood

By Kenneth R. LaVoy

THESE convenient and novel containers for cigarettes can be made easily from the thin wood obtained from cigar boxes. Their construction affords a pleasant evening's diversion.

The idea was suggested by a commercial article of metal; but, to most of us, an object of our own manufacture has greater intrinsic value than any store product.

Three designs or styles of holders are shown. The man who wishes the results of his labors to be distinctly individual can modify them for his own use.

Take a cigar box apart carefully, saving the nails. Remove the paper labels and bindings by scraping or steaming—the latter being preferable. Use the inside surfaces of the box for the outside of the

Wood from cigar boxes is used in making these unusual cigarette holders. They may be finished with stain and varnish, wax, enamel, or a brush lacquer

holder, selecting or cutting so as not to use the wood branded with printing.

It will be noticed that in the No. 3 holder the bottom slopes toward the opening. This incline is sharp enough so that the cigarettes roll to the opening, facilitating their removal. The design cut in the side of the holder adds much to its appearance.

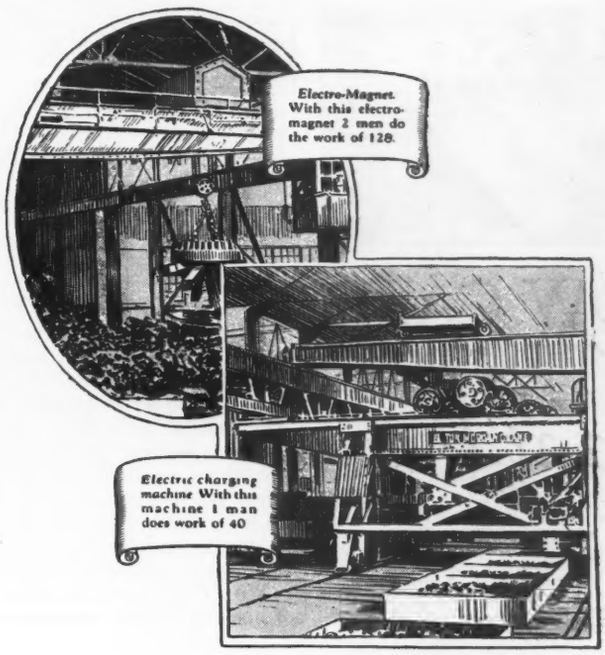
In holder No. 1 the cigarettes stand vertically. This holder is the simplest from the standpoint of construction. The design of No. 2 is a combination of ½-inch circles connected by straight lines.

The tools needed are hammer, knife, small, fine tooth crosscut saw, block plane, coping saw, compass, rule, and fine sandpaper. Care must be exercised in cutting the curved parts so as not to chip or split the wood.

A stained finish is desirable, although the holders would be attractive if finished in colored enamels or lacquers.

Likes Our Blueprint Models

AM WELL pleased with the way my pirate ship model turned out; every part fitted perfectly. I sold my model of the Spanish galleon for $50 before it was half completed and can sell all I can build by putting them in a hardware store window.—L.G.D., Rochester, N.Y.


Electro-Magnet. With this electro-magnet 2 men do the work of 128.
Electric charging machine With this machine 1 man does work of 40

"Nobody lifts anything—*nobody sweats*"

said Sir Ernest Benn, an eminent British publicist, after a tour of America's industrial plants. He was deeply impressed with our vast investment in labor-saving machines.

American industry employs hundreds of ingenious machines to save men from grueling tasks. And, wherever electricity is broadly applied, the worker's day is shorter, he is well paid, and he accomplishes much.

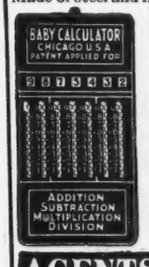
There are in America industries so vast that each would need the man-power of half the nation if there were no machines such as these with their General Electric motors. In every step of manufacture, mining and forestry, through mill and factory, motors do the manual tasks with great saving of men and money.

GENERAL ELECTRIC

ADDING MACHINE VEST POCKET SIZE

ADDS—SUBTRACTS—MULTIPLIES—DIVIDES

Does work of $300 machine. Guaranteed 5 years. NOT A TOY.
Made of steel and indestructible. Million dollar capacity. Fits in pocket. Will not make mistakes. So simple child can operate it. Everybody should carry one for figuring.



$2.50 TOTAL COST

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Send No Money—Just name and address. We will ship Calculator immediately. On delivery pay postman $2.50, plus few cents postage. If not satisfied after 10-day trial get your money back. THOUSANDS OF SATISFIED USERS.
This is the lowest priced practical Calculator made. "Why pay more for inferior imitations?" Order from this ad.
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This Year—make it a Real Vacation!

Thrilling, foaming speed with the Super Elto outboard motor! Instantly attached to any rowboat. Easily portable. World famous for easy starting. Multiplies the pleasures of fishing, racing, vacationing. Write today for new catalog—beautifully illustrated—intensely interesting.

Elto Outboard Motor Co.
Ole Evinrude, Pres.
Dept. W, Mnfrs. Home Bldg.
Milwaukee, Wis.

The Super Elto

"Starts With a Quarter Turn"

SHOW CARD LETTERING *Learn at Home*

HERE is the very course you need if you want to get a good paying position as a Show Card Letterer or Sign Letterer, or have a business of your own. This course is complete and practical and especially arranged to meet the needs of the student who studies at home. It was written by E. L. Koller, Principal of the School of Art of the International Correspondence Schools, member of the American Federation of Arts, and The National Society of Craftsmen.

Mr. Koller has had twenty years' teaching experience, and his success in helping other men and women is an indication of what he can do for you.

H. L. Wood, a clerk, made more than $700 "on the side" before he had completed his course and also won $125 in prizes. Harry William Lord writes that he has more than doubled his salary as a result of studying this I. C. S. course in spare time. William Whitman, a former wagon builder, now has a sign painting business of his own and is earning *nearly three times* as much as he did before enrolling with the International Correspondence Schools.

There is no doubt that Show Card Lettering and Sign Lettering offer a real opportunity to ambitious men and women. Just mark and mail the coupon and we'll gladly send you a booklet telling all about the I. C. S. course in Show Card Lettering, or any other subject in which you are interested.

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Without cost or obligation on my part, please tell me how I can qualify for the position or in the subject before which I have marked an X:

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Own a CORONA

The portable typewriter built like an office machine. Has four-row keyboard and big-machine features throughout. Write to L. C. Smith and Corona Typewriters Inc, 715 E. Washington St., Syracuse, N. Y.

SQUAB BOOK FREE

Make money breeding squabs, sold by millions; write at once for free 40-page book, beautifully printed in colors, telling how to do it. Read how marketmen Conron, Schweitzer, Sils, of N. Y., want thousands squabs daily, demand enormous. It pays to raise this luxury product. Ready for market in four weeks. We ship breeders everywhere on three months' trial. Read how one started small in backyard with no money, now has $30,000 plant, ships 150 bbls. squabs yearly, paid $75-$100 bbl. You can do the same. Many other accounts money-making by men, women, everywhere. Write today. You will be surprised.

PLYMOUTH ROCK SQUAB CO.
616 H St., Melrose Highlands, Mass. Established 26 years

Better Shop Methods

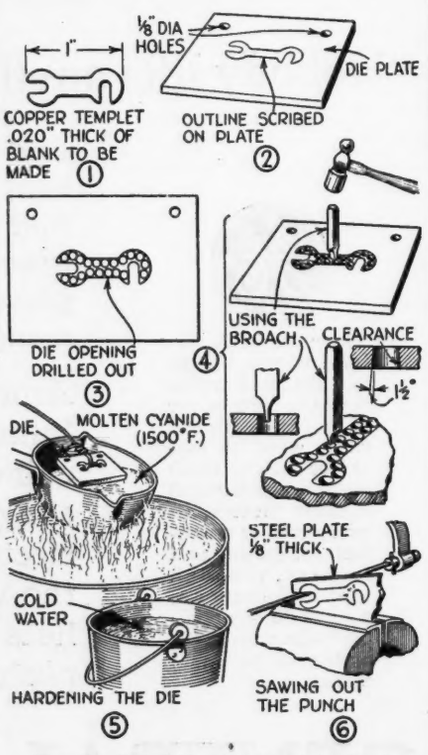
Hints on Preparing Simple Dies for Small Parts

By D. A. ROGERS

Instructor in Machine Shop Practice, University of Minnesota

SHOPS engaged in experimental work, as well as amateur mechanics, sometimes face the problem of making a number of small sheet metal parts by hand. The number is usually not sufficient to warrant making punches and dies, although they would be desirable from many points of view, and would tend to improve the appearance of the machines or devices under construction and insure the interchangeability of the parts.

With these needs in mind, the details of making a most inexpensive temporary



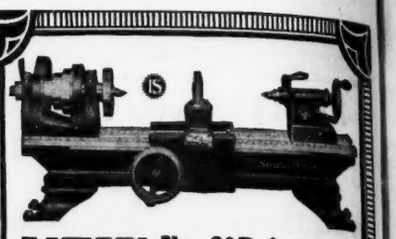
How the die is laid out, cut and hardened in cyanide; the first step in making the punch

punch and die will be given. They are capable of producing perhaps a thousand blanks and yet they can be made in a few hours.

Let us assume that the die is to be made to produce the blank in Fig. 1, and that there is no sample. The first thing to be done is to make a templet by hand to the exact dimensions, or, if the shape permits, the outline may be laid off directly on the die.

Having made the templet, select a piece of ⅛-in. cold rolled steel, in this case about 1½ by 2 in. The top side should be polished with fine emery cloth and blued by heating over a flame. The templet is clamped at about the center of the die in order to mark the outline with a sharp scriber (Fig. 2).

The opening in (*Continued on page 115*)



NEW No. 20B LATHE $100

9 in. x 2½ ft.; 11½ in. between centers

No. 20-B is our regular Quick Change Gear Lathe stripped of all extras that are not needed in the small shop. Can be furnished with 3, 3½ or 4 foot Bed—also Compound Rest and Long Legs at slightly extra prices.

Can Do All This Work

—Turn Commutators, undercut Mica, turn Pistons, can be fitted with 6-in. Chuck, will bore, drill, etc., can also be fitted with our draw-in chuck attachment, capacity of Collets 0 to ½ inch. Write for Folder No. 20-S.

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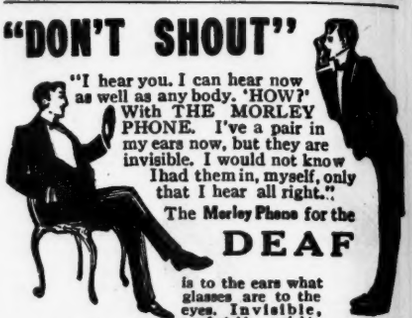

"I hear you. I can hear now as well as any body. 'HOW?' With THE MORLEY PHONE. I've a pair in my ears now, but they are invisible. I would not know I had them in, myself, only that I hear all right."

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is to the ears what glasses are to the eyes. Invisible, comfortable, weightless and harmless. Anyone can adjust it. Over one hundred thousand sold. Write for booklet and testimonials.

THE MORLEY CO., Dept. 797, 10 S. 18th Street, Philadelphia

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Here is a letter we received from a lady from way out west.

Gentlemen:
My boys were so delighted with the Zip-Zip shooters that they ordered from you that I am enclosing check for one dozen more, I want each of their friends to have one also. Please send these as soon as possible.

Thousands of boys are made happy with this wonderful Zip-Zip shooter. Order from us or your dealer. 35c each or 3 for $1.00. Send stamps, coin or money order.

AUTOMATIC RUBBER CO., Dept. 22, COLUMBIA, S. C.

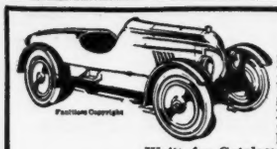
30 Days' Free Trial

Select from 44 Styles, colors and sizes, famous Ranger bicycles. Delivered free on approval, express prepaid, at Factory Prices, from $21.50 up.

$5 a Month if desired. Parents often advance first deposit. Boys can earn small payments.

Tires wheels, lamps, horns, equipment at half usual prices. Send No Money. Write for our marvelous prices and terms.

Mead CYCLE COMPANY DEPT. F250 CHICAGO Write us today for free catalog



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$39.00 buys this RACEABOUT torpedo body in gray prime for your Ford. Special hood and bullet nose shell.

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AMERICAN TOP & BODY CO.
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Getting Ahead?

Read the advertisements on Pages 118 to 143 this issue if you want to get ahead!

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

Better Shop Methods

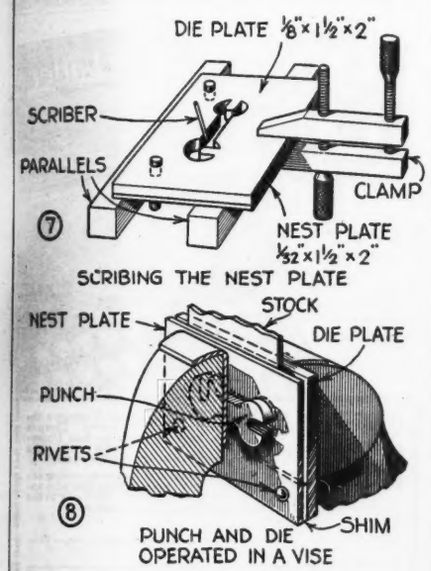
Preparing Simple Dies

(Continued from page 114)

the die, or as much of it as possible, is drilled out (Fig. 3); the burrs are removed; then the webs between the holes are cut out with a broach (Fig. 4). This somewhat resembles a chisel, but is driven into the die from the top half way through while the die rests on an anvil, after which the die is turned over and the other side cut through.

The die opening then is carefully filed to the line, after which the bottom side is filed a trifle larger than the top; this clearance usually is 1½ deg. Two ⅛-in. holes are drilled in the die to hold a nest or guide, and the die is ready to be hardened.

This is done with cyanide of potassium, or some prepared casehardening compound. The die may be heated in the fire



Transferring outline to the stripper plate, and one method of operating punch and die

until it is a bright red and the powdered cyanide sprinkled on and allowed to melt, after which the die is reheated to a bright red and quenched in clean cold water. A better way (Fig. 5) is to melt a quantity of cyanide in a small ladle and heat it to about 1500 deg. F. The die is immersed in this at the end of a wire for about twenty minutes, when it is quenched as before. Those not familiar with cyanide are cautioned that it is a very deadly poison; the fumes must not be inhaled, and the bucket in which the die is quenched should not be used for washing.

The punch is made of a small piece of ⅛-in. steel. It is blued in the same manner as the die and clamped tightly against the die so that the outline can be scribed. The surplus stock is removed with a hacksaw (Fig. 6) and the punch filed until the line is halved. It should then be tried in the die; it probably will have to be forced in, but that will shear off the high points. Draw-file the punch to remove the shear marks and file the clearance taper of 1½ deg. The punch then is hardened with cyanide.

A piece of ½-in. sheet steel (Fig. 7) is fitted to the die (Continued on page 116)

GOOD TOOLS STOP WASTE

SIMONDS
CIRCULAR SAWS

BY specifying SIMONDS, in buying tools, you are assured of speedy, economical production and the finest cutting quality—quality born of Simonds near-century of experience in making tempered steel cutting edges. Whatever YOUR cutting problem may be, put it up to Simonds. Ask your supply house, or dealer or write direct.

SIMONDS SAW AND STEEL COMPANY
"The Saw Makers" Fitchburg, Mass. Established 1832
Branch Stores and Service Shops in Principal Cities

SIMONDS
Pronounced SI-MONDS
SAWS FILES KNIVES STEEL

$25 in Cash Prizes See Page 4 in front of book for details

Buy Direct From Mill! This 5 Room Home $1795

Gordon-Van Tine Home No. 633, 5 rooms and bath; many built-in conveniences. Materials $1795

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Get our low *wholesale prices* before you build. Many say they save as high as $2,000. We furnish complete plans and *highest quality* material. Framing lumber cut at mill saves 30% labor cost. No costly hand-sawing. 200,000 customers make our values possible

Many Buyers Put Up Own Homes Plans so simple and parts fit so accurately many construct own homes. Most permanent construction.

5,000 Building Bargains Everything for building, remodeling or repairing, at wholesale prices. Send for catalog.

Mail Coupon "*Book of 200 Homes*" shows photos, floor-plans, prices of Bungalows, Colonial—modern, distinctive 4 to 9 room homes.

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"How I Licked Wretched Old Age at 63"

"I Quit Getting up Nights—Banished Foot and Leg Pains . . . Got Rid of Rheumatic Pains and Constipation . . . Improved Embarrassing Health Faults . . . Found Renewed Vitality.

"At 61, I thought I was through. I blamed old age, but it never occurred to me to actually fight back. I was only half-living, getting up nights . . . embarrassed in my own home . . . constipated . . . constantly tormented by aches and pains. At 62 my condition became almost intolerable. I had about given up hope when a doctor recommended your treatment. Then at 63, it seemed that I shook off 20 years almost overnight."

Forty—The Danger Age

These are the facts, just as I learned them. In 65% of all men, the vital prostate gland slows up soon after 40. No pain is experienced, but as this distressing condition continues, sciatica, backache, severe bladder weakness, constipation, etc., often develop.

Prostate Trouble

These are frequently the signs of prostate trouble. Now thousands suffer these handicaps needlessly! For a prominent American Scientist after seven years of research, discovered a new, safe way to stimulate the prostate gland to normal health and activity in many cases. This new hygiene is worthy to be called a notable achievement of the age.

A National Institution for Men Past 40

Its success has been startling, its growth rapid. This new hygiene is rapidly gaining in national prominence. The institution in Steubenville has now reached large proportions. Scores and even hundreds of letters pour in every day, and in many cases reported results have been little short of amazing. In case after case, men have reported that they have felt ten years younger in six days. Now physicians in every part of the country are using and recommending this treatment.

Quick as is the response to this new hygiene, it is actually a pleasant, natural relaxation, involving no drugs, medicine, or electric rays whatever. The scientist explains this discovery and tells why many men are old at forty in a new book now sent free, in 24-page, illustrated form. Send for it. Every man past forty should know the true meaning of those frank facts. No cost or obligation is incurred. But act at once before this free edition is exhausted. Simply fill in your name below, tear off and mail.

The Electro Thermal Company
4061 Main Street Steubenville, Ohio

THE ELECTRO THERMAL CO.,
4061 Main Street, Steubenville, Ohio.

Name.....

Address.....

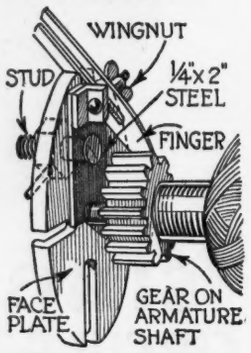
City..... *State*.....

Western address: Suite 40-D, 711 Van Nuys Bldg. Los Angeles, Cal.

Better Shop Methods

Special Driver Assists in Truing Commutators

TO SAVE time in truing small commutators having a gear on the end of the shaft, I made the driver illustrated. Prior to making this device it was the practice to tie the gear to the face-plate with wire, as there were no dogs large enough to go over the gears.

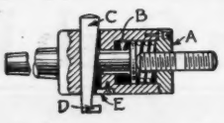


The driving device, as shown, engages the gear

A pin was placed in the stud nut, and a wingnut provided for adjusting the finger so that the work could be set up without the use of wrenches.—J. D. GEORGE.

Quick-Acting Holder for Threading Studs

MECHANICS who have worked in the smaller shops know how difficult it is to thread studs or nipples by the antiquated method of holding them in a plate from which they must be removed with a pipe wrench. To speed up the threading of this class of work and make it easier, the holder illustrated was designed. It has proved to be quite satisfactory.



A wedge is used to lock the stud for threading

The parts are shown in position for threading the stud, which is afterward released by striking end D of the wedge.

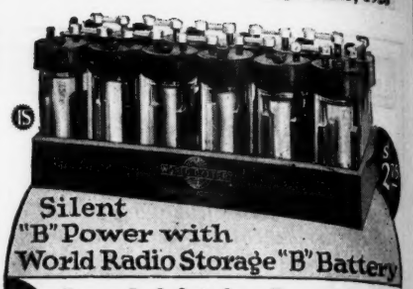
The thread should be loose enough so that the stud may be removed with the fingers, after which the wedge is struck on the end C to drive the ram B against the next stud to be threaded. The plate A is held by several screws, and a number of sizes can be made and used on the same body.—FRANK N. COAKLEY.

Preparing Simple Dies

(Continued from page 115)

to act as a nest for the punch. This has an opening exactly the same size as that in the die, and is riveted to it through the holes previously drilled. Between the nest and the die is put a shim to act as a guide for the stock and also to hold the nest sufficiently above the die to permit the stock to be inserted.

While the die may be operated in a regular press, and should be for any considerable quantity of pieces, a few can be made very satisfactorily in a bench vise (Fig. 8). A slight turn of the screw forces the punch through the stock, whereupon the parts are taken from the vise, the blank removed, and the die prepared for the next piece.



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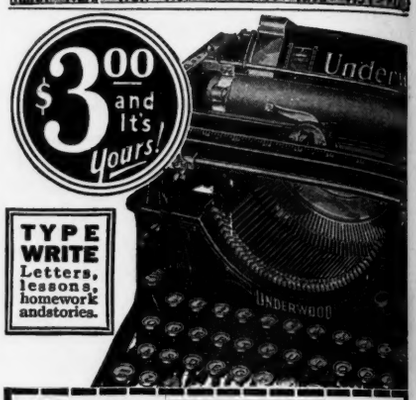

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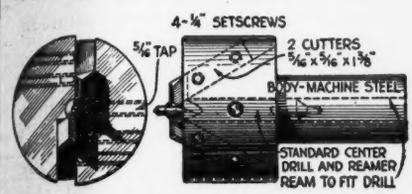

A standard centering drill and two spot-facing cutters mounted in a simple holder

it insures quicker setting of the piece for subsequent operations.

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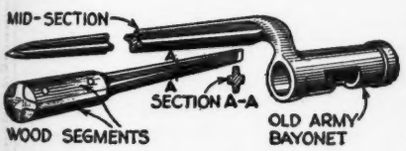

The type of bayonet used and one of the screw drivers made from the thicker end

blade and were ground only enough to give the tool the proper shape.

One bayonet is large enough to make three or four screw drivers in a graduated set for work ranging from light to very heavy. A large, heavy, short screw driver is illustrated. In the same set is also a long screw driver with a fine end for light work. This is made from the tip of the bayonet.—S. W. BLANCHARD.

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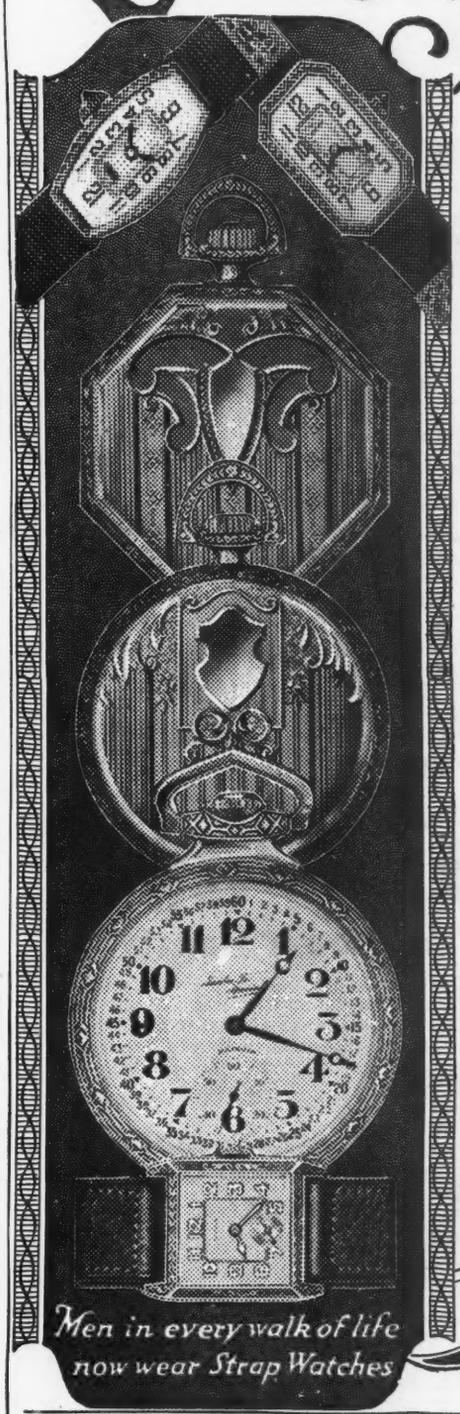

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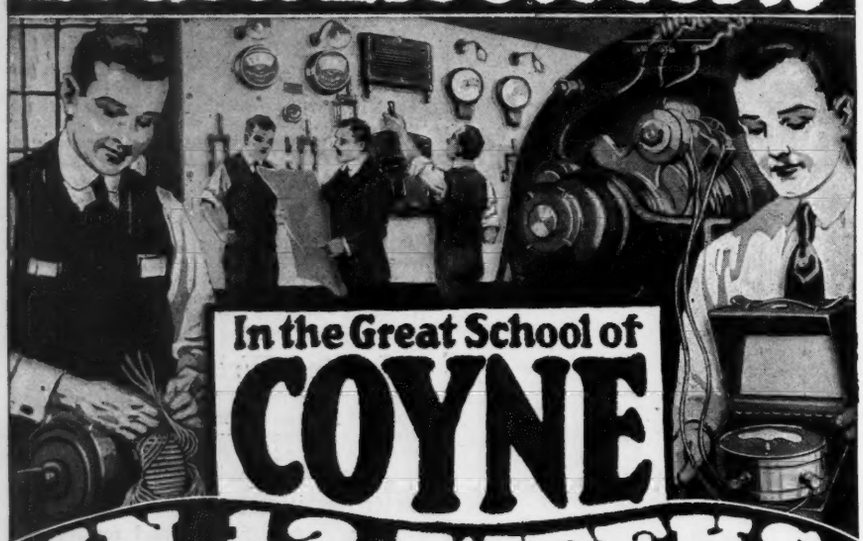

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(*Continued from page 4*)

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Better Shop Methods

Squaring Your Squares

(*Continued from page 74*)

the chances down to an uncomfortably small number when we consider further that there is a permissible error in any square, and that this "tolerance" error may add itself to, or subtract itself from, the undue error, the existence of which it is sought to disprove.

A few moments' consideration will suffice to show that if we try to depend on the law of probability to prove our case, we might just as well drop the matter and quit talking about accuracy. So the fact remains that at the end of the eighth test, both squares had been proven 25 percent right, and they remained unproven to all theoretical and practical purposes, 75 percent.

And yet only one more test would have been needed to prove both squares, namely No. 9, Figs. 1 and 2. This, added to the previous tests, at once

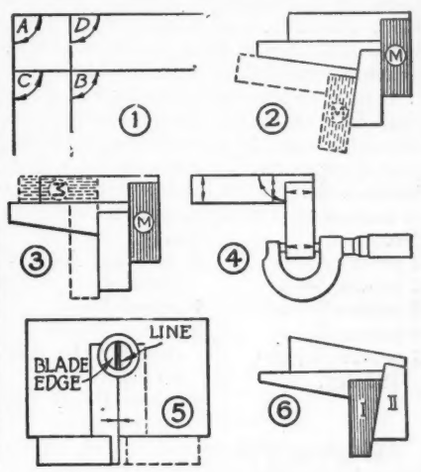


Fig. 3. The angles to be tested (1); possibilities for error in tests (2, 3 and 6); a reliable test for toolmakers to use (4 and 5)

proves the remaining 75 percent, and if both squares are 100 percent true (discounting the permissible or "tolerance" errors) they are then proven to be square.

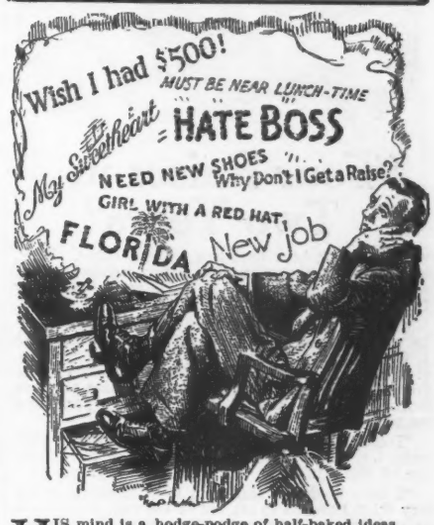
What particular magic, then, is there in test No. 9? There is no magic at all. No. 9 has no more power than any of the remaining tests, though in the particular sequence in which they are shown, No. 9 happens to be the one which supplies the missing link, just as the snap hook at the end of a chain forms the link which converts the chain into a ring.

Then what is the explanation? It is necessary, to understand the matter, that we get a distinct conception of what we are trying to do. And the first thing we must get clear is that when we are trying to establish the accuracy of two unknown try-squares by trial with each other, we are trying to establish two pairs of three separate angles each as ninety degrees, by comparing two similar systems of angles with each other.

The simplest, and in fact the only practical way to show what happens, is to resolve the question into a geometrical problem. If we represent the edges of the handles and (*Continued on page 126*)

Scatter-brained!

No wonder he never accomplishes anything worthwhile!



HIS mind is a hodge-podge of half-baked ideas. He thinks of a thousand "schemes" to make money quickly—but does nothing about any of them.

Thoughts flash into and out of his brain with the speed of lightning. New ideas rush in pell-mell, crowding out old ones before they have taken form or shape.

He is Scatter-brained.

He wonders why he does not get ahead. He cannot understand why others, with less ability, pass him in the prosperity parade.

He pities himself, excuses himself, sympathizes with himself. And the great tragedy is that he has every quality that leads to success—intelligence, originality, imagination, ambition.

His trouble is that he does not know how to use his brain. His mental make-up needs an overhauling.

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Admiral Lord Beresford, G.C.B., G.C.V.O.
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Better Shop Methods

Squaring Your Squares

(*Continued on page 125*)

the blade by sets of parallel lines, we have No. 1, Fig. 3, with angles A, B, C, D. It needs only elementary geometry to show that if any three of these angles are equal, the fourth must be equal and each set of lines parallel, but that if only two angles are equal, then no combination of two angles can prove what we require.

IN A try-square the handle is in the way of comparing angle C, so the most practical statement of the problem before us is that we are to prove

A = B = D = 90 deg.

And, naming the angles in the other square a, b, c, d, also

a = b = d = 90 deg.

It is well to understand clearly that these six angles are six separate and distinct elements, and that, for instance, by proving A = 90 deg., we by no means prove corresponding angle a = 90 deg.

If now we consider critically Fig. 2, we shall find that each of the nine tests established the equality of some one particular pair of elements, the elements being contained either in the same square, or one in each of the two squares, as follows:

No.	No.
1 proves A = b	6 proves A+a = 180 deg.
2 proves A = b	7 proves D = d
3 proves B = a	8 proves D = 90 deg. (or else d = 90 deg.)
4 proves B = a	9 proves B = D (or else b = d)
5 proves D+d = 180 deg.	

Any group of these tests which establishes A = B = D = 90 deg. will have proven square *I* true all over, and if, incidentally or otherwise, we prove a = b = c = 90 deg., we shall also have proven No. *II* all over. And any group of tests, no matter how numerous, which falls short of this will fall short of proving the squares.

OUR mechanic, after performing the first six tests, had after all only proven A = b, B = a, D+d = 180 deg., and A+a = 180 deg. It is clear that not one of the conditions of the problem had been fulfilled, and that therefore nothing had been proven. By adding test No. 7, which proved D = d, both were also proven = 90 deg., as according to 5, D+d = 180 deg. No. 8 proved D = 90 deg., and if repeated on *II*, d = 90 deg., therefore adding nothing to the information. But by adding test No. 9, we prove B = D. As D = 90 deg., this makes B = 90 deg. B = a, hence a = 90 deg. As A+a = 180 deg., it follows that A = 90 deg. This completes the proof and fulfills the condition, for now A = B = D = 90 deg.

It will also be seen that by a proper choice of tests, five of the nine tests can be avoided if we wish to prove only one square right all over, and that seven tests will prove both squares all over. The two tests which can be left out are, of course, Nos. 2 and 4, which merely duplicate Nos. 1 and 3.

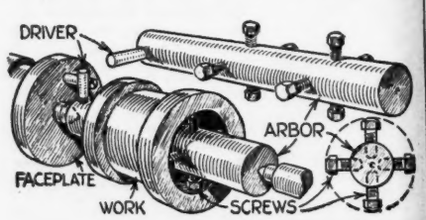
This is equivalent to saying that it requires four tests to prove two squares, the accuracy of both of which is unknown and three tests if we use in our own testing one square of proven accuracy. This will be found to hold true by trial or calculation. No. 2, Fig. 3, for instance, shows tests 1 and 3 insufficient to establish the accuracy of the square being tested. Tests 3 and 7 are equally inconclusive. (See No. 3). But tests 1, 3 and 7 prove the desired result a = b = d = 90 deg. The reason, is that by using a proven square, while we are still examining only one element at a time, we establish the equality of that element not only with another element, but also with 90 deg., thus reducing the number of necessary tests by one.

Proven try-squares of high accuracy, however, are expensive and consequently not very numerous, and many of those originally accurate become questionable in continued use. If they are not actually inaccurate, at least it becomes problematical if they are.

For the toolmaker or machinist, who has micrometers and magnifying glasses always available, one of the best ways of testing his square independently, when no proven right angle is at hand, is that shown at Nos. 4 and 5, Fig. 3. The test consists in measuring the parallelism of the handle and blade, and then applying the reversing test on a highly-polished straight-edged steel block, drawing a very fine line against the edge of the blade, and running the reversed blade to within about .003 in. of the line, when he will be able to estimate the error to .002 in. or less, as any existing error will appear doubled.

Centering Large Castings with Very Little Stock

A SMALL shop was confronted with the problem of machining a number of castings upon which there was so little stock that they could barely be cleaned up. It was too tedious a job to adjust them in the regular four-jawed chuck, so a piece of scrap shafting was drilled and tapped for eight screws, thus making an improvised arbor.



Improvised arbor used to support castings that have little surplus stock for machining

The arbor, once made, could be used for any size casting within reasonable limits by using screws of different lengths.

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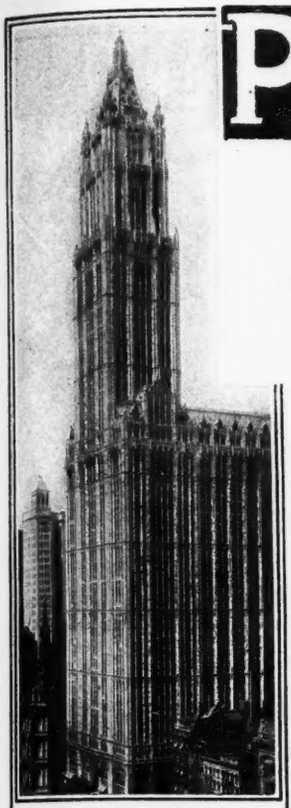

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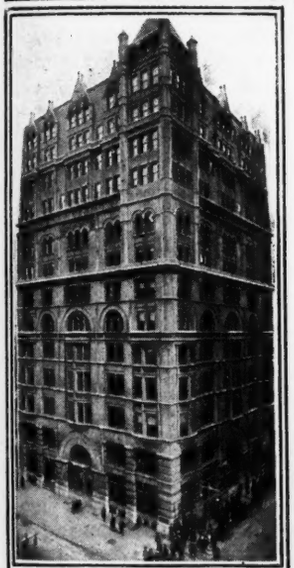

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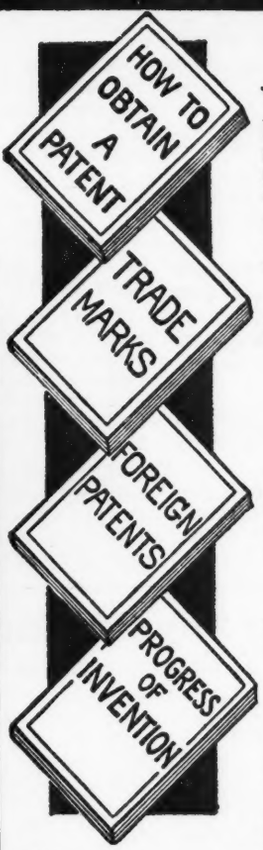

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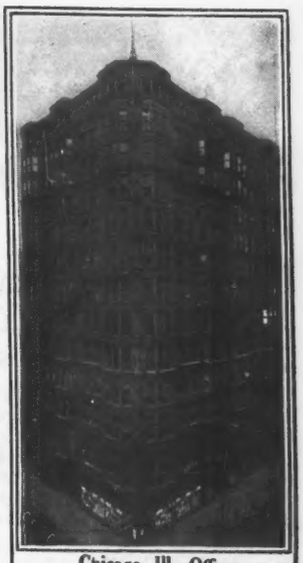

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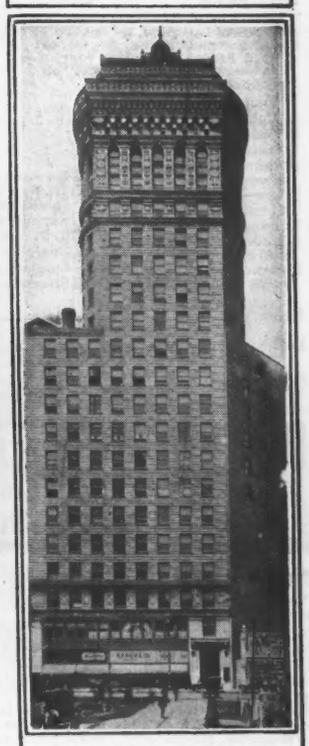

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Better Shop Methods

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Old Bill, machine shop foreman

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And, incidentally, return them in as good or better condition as when you took them out.

Never stand in front of a new grinding wheel when starting it up the first time.

Do not let a grinding wheel stand in water when idle, as it throws the wheel out of balance.

Wear goggles at all times when dry grinding; they may be uncomfortable, but they're not nearly so bad as an injured eye.

Be extra careful in removing or replacing the safety hood over a grinding wheel.

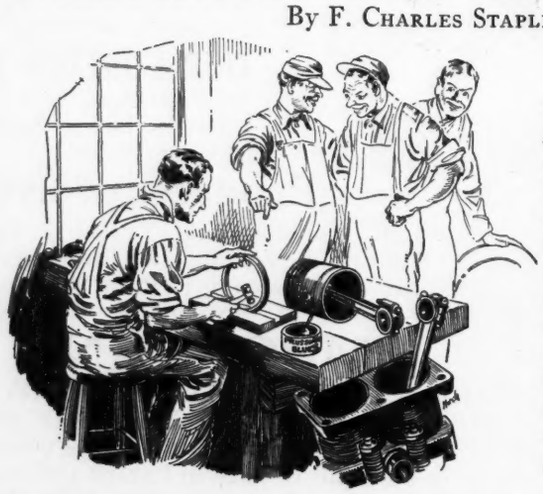
What has become of the good old tramp machinist who knew so many makeshift kinks?

Using a hammer or any extra leverage on a machine vise handle strains the screw and quickly ruins the vise.

When clamping finished work in a milling machine or shaper vise, use strips of heavy drawing paper between the work and the vise jaws to avoid marring the work.

What I Have Saved by Peening Piston Rings

By F. Charles Staples



AMONG the interesting responses to an article on page 112 of the February, 1926, issue of Popular Science Monthly, *"How to Fit Piston Rings by the Peening Method," the following, by a reader who lives in Toronto, Canada, and styles himself "one of the old school," is especially illuminating. It reveals the ingenuity that always distinguishes the true mechanic, and shows how care and thoughtfulness make for success in the machine shop.*

IN CONNECTION with the article about peening piston rings, I would like to offer some experiences I have had in that line.

The first that comes to mind was in connection with an 8-horsepower, single cylinder vertical engine with a 5-in. bore used on the very dirty job of running a coal screen. Naturally, at every stroke of the piston, fine hard dust would be sucked in despite a series of inclosing screens. After two years' work the engine became so weak that we pulled it down. I found the cylinder in good condition, that is, it was smooth, but was $\frac{9}{32}$ in. out of round.

Reboring seemed too costly at that time, and as we could not get commercial rings, I decided to make some new ones myself. Another argument in favor of not reboring was that the walls of the cylinder were smooth and hard, and I disliked to destroy this excellent surface, for I felt that in a short time the coal dust would grind into the freshly bored surface.

I found a piece of scrap casting and turned some rings. I made them $5\frac{3}{8}$ in. diameter outside and $4\frac{9}{16}$ in. inside, and cut them off $\frac{5}{16}$ in. to fit the ring grooves. I cut a slot the width of two hacksaw blades at 45 deg. and tried the ring in the cylinder. There was $\frac{3}{32}$ in. between the wall and the ring on the thrust sides, so I put the ring in a groove in a piece of pine board and proceeded to peen the inside of the ring until it fitted fairly snug all around. Then I blued the cylinder and put the piston and one ring in. Every particle of the blue disappeared, so the fit was good. I did the same with the other three rings, and put in dowels so they would not move from the position in which they had been fitted.

Several who saw all this careful work laughed at me, and said it would last about a day. I assembled the engine, and put a belt on it and ran it with other power for about an hour and a half, pouring copious quantities of oil into the cylinder. Then I cleaned out the oil, put in the valves, completed the assembly, and turned on the gas and spark, whereupon the engine went to work.

The engine was immediately put to work, and has run for two years continuously for six days a week without any trouble, thus (*Continued on page 129*)

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Better Shop Methods

Peening Piston Rings

(*Continued from page 128*)

showing that a little extra effort is justified in the fitting of the rings. The only cost to this job was the labor.

Another incident that happened years ago may be worth mentioning. A certain large motor car only about three months old was giving trouble by pumping oil. An engineer was sent up from the factory to see what was the trouble. He tore the engine down, used micrometers on almost every part, but could find nothing wrong. He put it up again, and it ran fine for a day, and then the old trouble developed. He pulled it to pieces once more, but with the same result. Then he got disgusted and wired his factory to send him a new motor and left the old one. Apparently he did not wish to send it back to the factory since he could not locate the trouble.

AT THAT time this engine was selling for about $2800, but I got a man to buy it for me for $50. I fitted new rings to it as I later did to the one cylinder engine, and it ran a boat up here for a long time, giving excellent service.

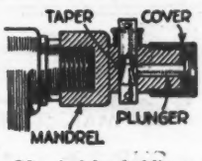
My work consists of overhauling heavy duty truck engines, and I continually find it better to peen out the new rings, the more so when the cylinders have been rebored before. I may say that I am called upon occasionally to do over the work of other men, and frequently all that is necessary is to give the rings a little peening and proper fitting.

The trouble I find with most mechanics, and, I might add, some well informed auto engineers, is that they know absolutely nothing about expansion and contraction of the various metals with which they are in contact in their daily work. Were you to ask the average mechanic anything about the temperatures in a gas engine cylinder, or even the boiling point of water, he could not answer you.

I COULD go on at some length dilating upon my experiences of more than twenty years, but I am afraid I have taken up too much space already. It all comes down to this: to have any success, you have to know how, and must get away from the idea that the knowledge can be picked up in a few weeks.

A Releasing Mandrel for Thin Threaded Brass Covers

A SMALL-PARTS department, with a quantity of brass covers to make, had difficulty in getting them off the mandrel used for turning the outside because of their extreme thinness. One of the toolmen suggested constructing a mandrel as shown. This can be released by striking the spring-supported end of the tapered plug, thereby relieving the pressure on the plunger and permitting the cover to be unscrewed with the fingers.—F. N. C.



Mandrel for holding thin threaded parts

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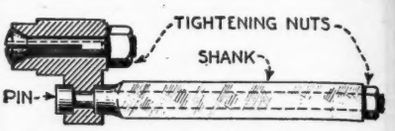
Better Shop Methods

Bench Lathe Tool Holder Is Adjusted Easily

SMALL round shank boring or turning tools for delicate bench lathe work can be held conveniently in the holder illustrated. The tool can be adjusted

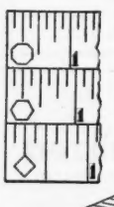


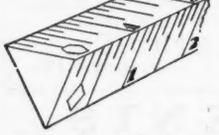
This bench lathe tool holder is for small boring or turning tools with round shanks

vertically as well as revolved in the holder, so that an exact setting can be obtained. The parts should be finished to fit closely, and in use the two nuts must be drawn up tightly

Clearance Scale for Nuts

PATTERN MAKERS and draftsmen who are concerned with whether a nut will clear an adjacent part will find the scale illustrated a useful tool. It has on its three faces the distances across the corners of squares, hexagons, and octagons, while the figures represent the corresponding dimensions across the flats.



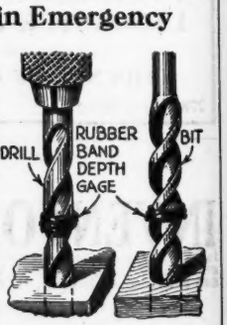


Triangular scale for figuring of clearances

To make a hardwood scale of this kind, the face for the square is laid off so that the figure 1 will be a distance of 1.414 in. from the end; the face for the hexagon will have its 1 at a distance of 1.155 in. from the end, and the 1 on the octagon face is 1.082 in. from the end. Units are subdivided into eight parts, so the scale may be read as is a rule. Birch and maple are suitable woods for making the scale.—J. A. MILLER.

Rubber Band Utilized As Drill Depth Gage in Emergency

MACHINISTS use all sorts of ways for regulating the depth of a drilled hole when it is essential not to drill too deep. Some measure and mark the drill with a file; others use a collar screwed to the drill. Twine and wire are often utilized. One of the simplest depth marks, however, is a rubber band wrapped around the drill body as shown.—G. A. LUERS.



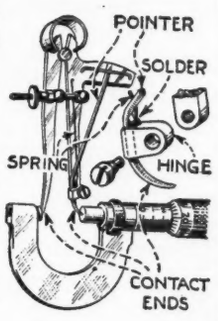
Simple rubber band depth gage for use on drills and wood bits

EXCESS oxygen in a welding flame tends to decarbonize iron or steel rapidly.

Better Shop Methods

Pointer on Inside Caliper Indicates Size of Hole

TO AVOID having to depend on the sense of touch when measuring small bored holes, the writer made a new leg for a pair of 2-in. spring calipers and attached an indicator pointer and a spring. The pointer shows visually how near any hole is to the exact size.



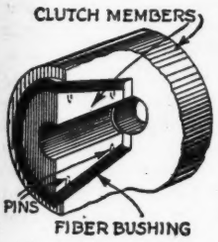
Setting the caliper with a micrometer

This caliper is most useful for testing the smaller holes, those too small for a commercial inside caliper. It should be set with a micrometer so that the pointer will be on the index line when the hole is the required dimension.—D. A. R.

How to Attach a Fiber Sleeve to a Friction Clutch

DIFFICULTY often is experienced in attaching fiber sleeves to tapered metal parts such as used in friction clutches.

The fiber tubing for the sleeve should be about the same inside diameter as the small end of the tapered member to which it is to be attached. It must also be a trifle longer, as it will be shortened in the assembling.



Method of applying tapered fiber sleeve

Soak the fiber in cold water for about ten hours and press it in place. If the fiber tends to break, it must be soaked for a few minutes in water heated to about 180 deg. F., but must not be allowed to become too soft. Shellac, if applied to the metal just before the sleeve is forced on, serves as a lubricant and assists in retaining the sleeve when dry.

After drying a day, the sleeve should be pinned to the metal with hardwood pegs in a small clutch, or copper pins about 3/16 in. in diameter in a large clutch.

The finishing is done either by turning or grinding, preferably the latter.—S. W. BROWN.

Identifying Little Used Tools

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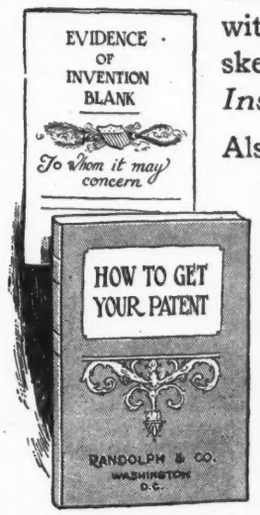

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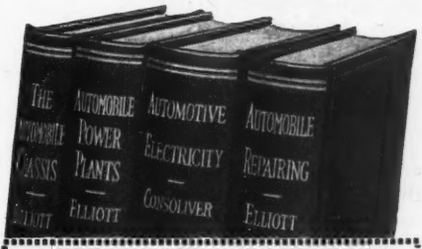

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SANCTIFIED MAGIC

(Continued from page 13)

will until he can control the minds of those about him, making them believe they actually see or hear what he suggests to them. The psychologists also remind us that hypnotism has been known in India for at least 2,000 years, and that the knowledge, handed down through countless generations by religious sects, has been gained by years of study, asceticism and the most exacting discipline of mind and body. In comparison, the Western world's scientific knowledge of the subject, gained in some fifty years of psychological research, is extremely meager.

AMERICAN magicians who have traveled in the Orient, however, assert these tricks have nothing to do with hypnotism, but are accomplished by methods similar to those of professional mystifiers. The exotic surroundings, they say, tend to make the feats seem more marvelous than they really are, and, in telling about them, witnesses almost invariably exaggerate.

Equally astonishing are the fakirs' apparent knowledge and practice of telepathy. Groups of fakirs living in various parts of India claim to have no need of the telephone or radio; they communicate with one another by thought transmission. In his American performances, Rahman Bey demonstrates his power of mind reading by obeying orders given mentally by members of the audience. Although the fakir can neither read nor speak English, if one of the audience writes on a slip of paper such an order as "Get my hat from my seat in the back row," hands the paper to another to hold, and concentrates his mind on the order, the fakir obeys it.

The fakirs insist there is nothing miraculous or supernatural about their feats. "Almost anyone can do the things I do," Rahman Bey explains through his interpreter, "but it takes long training."

TARAH BEY, a fakir who has attracted widespread interest in the capitals of Europe, declares, "I believe that the cataleptic state may be the real road to perfect health. We fakirs, even when not actually practicing, throw ourselves into this state which, I am convinced, is effective in cleansing the blood, clearing out impurities and inducing high physical resistance to disease."

In America, however, a number of scientists and medical experts have expressed themselves as extremely skeptical of the fakirs' reputed powers.

"Entertaining tricks in an atmosphere of mysticism," is the verdict given by Dr. James J. Walsh, eminent New York physician and psychologist.

"Burial alive—ten or even thirty minutes of being confined in a box completely covered with sand—is not even slightly dangerous," Dr. Walsh declares. "There is enough air in the box to keep a man alive much longer than that. Try it yourself. Wrap your head up tight for ten minutes. At the end of that time you will feel no ill effects. As for fakirs being buried for months and years—that is another story, but, I believe, a story that is always at least second hand when it reaches us. Moreover, in this connection there are many cases of fraud on record.

"In Egypt until recently there was a certain location especially favored by fakirs who indulged in being buried alive. After years of credulity it was found that the trunk of a large tree growing near the spot was hollow. Buried fakirs simply pushed the ends of their peculiarly constructed coffins outward, wormed their way through the loose earth until they reached this tree trunk, and escaped to the surface, living in seclusion until the time came for them to be 'dug up.' Whereupon they again took their 'cataleptic' attitudes in the coffins."

Doctor Walsh adds that any trained athlete might duplicate the feat of having a stone broken on his body while his neck and ankles rest on sabers.

"UNDER the long, flowing headdress worn by the fakir," he declares, "it is quite simple to wear a leather guard on the back of the neck, and, in the leg wrappings, to wear leather guards to protect the flesh from the blades. The 'stones' are of a loose composition that breaks easily. The force of the hammer blow is dispersed as the stone breaks. It is like hitting a taut string with your hand. If it breaks, the string doesn't hurt you.

"Again, fakirs in India who habitually lie on spikes have corns all over their backs, and this horny tissue protects them from pain. Moreover, a good athlete can so arch his body that the points of the spikes would barely touch him. When thrusting long knitting needles through the skin, fakirs lift the skin so that the needles pass through very little flesh. The skin on the upper arm and on the chest is especially well adapted for this stunt, being loose and flexible."

The great magician, Houdini, is equally convinced that the fakirs possess no extraordinary powers, although he concedes that their tricks are entertaining. Houdini offers to show anyone how to thrust an arm into a blaze without feeling pain.

"IT IS simply a matter of making the skin fireproof by anointing it beforehand with any one of a number of preparations," he says. "If you anoint your tongue with liquid storax, for instance, you can lick a red-hot iron without pain. Storax is one of the ingredients, too, in a compound which one may use to anoint the feet before strolling barefoot over a bed of glowing coals, another stunt of fakirs in the East.

"As for being buried alive, that is a feat that I have been performing for years. Moreover, I permit myself to be tied in a strait-jacket and nailed in the coffin—and I get out. That's a test for a fakir to try!

"However, as long as a fakir does not claim to possess supernatural powers, there is nothing for me to expose. He is an entertainer just as are other magicians, and to explain his tricks is not fair."

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The Cop Always Wins

(*Continued from page 11*)

the motorist. New York State, for example, now has a law that all motor cops must be dressed in uniform. Another recent law provides that villages no longer may pocket fines collected from motorists. Theyare allowed not more than one dollar per capita of population. Other states are adopting similar measures. In Texas, for instance, the legislature recently agreed on a jail term for any one found guilty of setting a motor trap. The law also throws out of court any testimony given by an officer who hides in ambush. A similar law is in force in California.

MEANWHILE, although there seem to be no sure-fire rules to avoid being fleeced as you tour the country, here are a few general precautions that may keep you out of trouble when you pass through a town or village:

Whenever you see a white line, painted down the center of the road, keep to the right of it.

Never pass a car on a hill or curve.

Proceed cautiously. Stay to the right.

Before attempting a left-hand turn, come to a dead stop.

When you see a "speed trap" warning, watch out.

Always pass around a "silent policeman" unless an officer directs you otherwise.

Keep enough cash in your pocket to pay a fine.

For remember that, right or wrong, the cop always wins.

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The First Great Salesman of Science

(*Continued from page 27*)

and fired into the minds of other men every new idea that came to him. Whether he was starting a public library which was to prove the ancestor of all others in America; whether he had in hand at the moment the organizing of a state militia or the borrowing of cannon with which to drill it; or whether he was busy creating Philadelphia's first fire department, with its "certain number of leather buckets ready for instant use," his method was always the same. First, he created the idea. Next, he went out and sold the idea to the public, not as his own conception, but as "the suggestion of a friend."

It has already been said that he had a curious faculty for self-analysis. This, of course, is shown by many of his writings and it appears that if he was not the actual inventor of modern psychology, he certainly was one of the first to apply it. Nowhere is his excellent use of this science shown to better advantage than in the attitude of the religious folk of the day toward him.

AS EVERYONE knows, Franklin had no particular religion—that is, no definite sect. John Adams wrote of him:

"The Catholics thought him almost a Catholic. The Church of England claimed him as one of them. The Presbyterians considered him half a Presbyterian, and the Friends believed him a wet Quaker."

He himself says that this nonsectarianism was what won him election, "merely as an honest man," to the board of trustees which controlled Philadelphia's general meetinghouse for preachers of every denomination. Having lost a Moravian trustee, and not wishing to elect another such, nor any from one of the sects already serving, the board compromised on Franklin, man "of no particular religion."

Yet he did have a religion—more properly a science of life. An amazing project for "arriving at moral perfection," a list, with a baker's dozen of virtues, ranging from Temperance through Silence and Order to Industry, Moderation and Chastity, was really a definite attempt to analyze himself and his moral progress. No man before Franklin had adopted the "graphic" or "chart" method of solving his moral problems. Practically speaking, this is exactly what this early psychologist did.

TO BEGIN with, he assumed that it would be impossible to acquire all the virtues at once; he must make a habit of each, in its turn. Accordingly, he bought an ivory-leaved notebook—for the frugal reason that its sheets could be cleaned and used again and again—and at the top of the first sheet he wrote "Temperance." Under this, he constructed a table, ruled horizontally for the days of the week and vertically for the other virtues in his list. If he decided, upon Sunday night, that he had not been temperate—that he had violated that virtue's explanatory precept, "Eat not to dullness; drink not to elevation"—down went a black spot at the proper intersection of his columns. For that week, the other virtues might get rather less attention, while he concentrated upon temperance. Next week, it would be the turn for Resolution, Sincerity, or Justice as the case might be. In a little over three months—for he had ruled off thirteen such pages—he had a complete record for all the virtues which he could analyze and, if he so desired, plot upon a drawing board like the curve of any other engine's performance.

WHAT he sought, of course, was the theoretical perfection of no spots on any of the thirteen pages. He admits his surprise at not reaching this perfection, and goes on to say that he reduced his analysis to "one course only, in a year," then to one in several years, and finally abandoned it altogether. But he continued to carry the book about with him, ready to take it up again at any moment.

It seems odd that a man who would take so much pains over tabulating his shortcomings should find his greatest difficulty with the virtue of Order. This, says Franklin, he found extremely difficult to acquire, and at length he had to be satisfied with "a faulty character" in this respect. Whereupon he recounts the tale of the man who bought an axe and wished to have it ground bright. The smith bade him turn the stone, while he himself pressed the axe down heavily. The man, growing tired of turning, stopped frequently and presently wanted to take his axe as it was. Upon the smith's pointing out that the metal was still darkly spotted, the man declared "Well, I think I like a speckled axe best!" Just so, Franklin finally accepted his quality of Order as speckled.

These stories or figures with a mechanical flavor were frequent with Franklin. Thus, he once wrote:

"The people have a saying, that God Almighty is himself a mechanic; and he is respected and more admired for the variety, ingenuity, and utility of his handiwork, than for the antiquity of his family."

THESE lines appeared in *Poor Richard*, that extraordinary creation of Franklin's which has run through scores of editions in nearly all languages and survived all the generations since its birth. English-speaking people, everywhere, chuckled over the almanac, while foreigners, the moment they read it in their own tongue, were equally amused. This was especially true of the French. The domestic science, as well as the thrift and the wit that sprinkled its pages, could not have been more nicely calculated to appeal to the French soul, which was thus opened and ready to receive Franklin when he came, years later, to Paris.

When he conceived this almanac idea, Franklin had no philomath, no combination of mathematician, astronomer, meteorologist and

(*Continued on page 135*)

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The First Great Salesman of Science

(Continued from page 134)

astrologer who predicted rains and droughts, eclipses, winds, and epidemics. Without, of course, openly admitting the fact, Franklin became his own philomath for his almanac writings.

No doubt *Poor Richard* was cribbed—freely plagiarized from every earlier philosopher. Rouchefoucauld, Rabelais, Bacon, and everyone else who had ever said anything worth repeating, contributed heavily. But Franklin's wide reading among these scientists of one order or another made this borrowing easy for him, and the salt of his own humor improved the flavor of the original.

THE necessity of being accurate in his almanac further increased his interest in science. Once, for example, having planned to view an eclipse, he found himself prevented by a northeast storm. But he learned from his brother that the eclipse had been visible in Boston. Inasmuch as Boston lies *north* and *east* of Philadelphia, Franklin at first considered this incredible, but he found it was true. Writing to friends in various parts of the country, he "tracked" that particular storm, with the times of its appearance at different points. From these, and other data which he carefully collected by observing subsequent gales, he deduced a theory to account for their behavior. Concluding that northeasters began to leeward and were even more violent there than to windward, he offered this explanation:

"Consider," he said, "a low tract of country, such as Georgia, to have continued clear weather, in which the atmosphere, heated by the sun, becomes rarefied and rises. Consider also the Philadelphia section as undergoing cloudy weather and cooler atmosphere at this same time. It will follow that the rising hot air must be replaced by a rush of cold. Now, when a canal of still water is opened for discharging, the *motion* of the water begins near the *opened* end and proceeds toward the *closed* end, although the water itself moves from the closed to the opened end. Just so with the air. The apparent result is that the motion moves backward."

IT IS important to note that the date of this eclipse which he could not observe was October 21, 1743. Franklin did not fix the date, but later students and scientists have done so. Thus it is possible to claim that he was the first to propose the theory of storms which is now generally accepted. And, with his never-failing proficiency in the art of "selling" others on the things that interested him, he used a picturesque though homely figure to illustrate his theory. Discovering the Law of Storms was not enough for him; he had to make sure that everyone should share the discovery with him.

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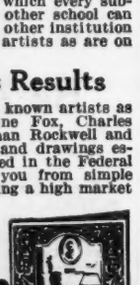

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Will It Be a Boy or a Girl?

(*Continued from page 24*)

she was at first a normal female. Suddenly, though, she stopped laying eggs. The eggs of another dove were offered to her care and she and her male mate hatched them, fed them normally for six days and then deserted them. This performance she repeated later.

Shortly afterward, she began to develop the characteristics of a male, notably the crow of the cock pigeon. And her size increased so that she became more nearly like a male in appearance.

Fifty-four months after this bird had laid her last egg she died, and the bird was unquestionably a male at death.

THE cases described are regarded by scientists as definite demonstrations of the actual occurrence of complete sex transformation in adult animals. Similar experiments with eggs are numberless. Dr. Riddle has changed the sex of many pigeons while still in the egg state. Dr. Robert K. Burns, Jr., of the University of Cincinnati, recently reported similar accomplishments with salamander eggs to the American Society of Zoologists. Dr. L. A. Banta of the Carnegie Institution conducted like experiments with water fleas.

Now, does this mean that sex transformation may become possible in human beings? Does it mean that parents will be able to bring into the world a boy if they prefer one, or a girl?

Dr. Crew, in telling the British Medical Association about his hen that turned rooster, was careful not to suggest that such a phenomenon might be accomplished with humans. However, he seemed confident that experimental work such as his would finally put into the hands of medical men such complete knowledge of the mechanism of sex that its artificial determination would become possible.

Prof. Julian Huxley, famous English scientist and senior demonstrator of zoology at Oxford, says great strides have been made in the study of sex determination and that within the next fifty years man may solve this problem. He makes this startling statement:

"Determination of sex is bound to come. As such a thing is bound to cause chaos, it is a problem that must be considered early, from all points of view."

AS MIGHT be expected, there is no unanimity of opinion in regard to this. Dr. William Blair Bell of the University of Liverpool told the American College of Surgeons in Philadelphia recently that he considered sex determination an "impossible dream, which is as it should be, for Nature knows what is best for the race." Professor Huxley, it will be noted, also saw a menace in sex determination and asked the Medical Research Council to take early cognizance of it.

Perhaps the clearest summary of the situation as it stands at present is that of Dr. Riddle:

"Complete sex transformation in human beings is certainly not imminent. Ultimately, yes. If complete transformation is established with relation to one set of hereditary characters carried in duplicate, like sex, why is not such transformation ultimately possible with other characters that are also represented by alternative genes or factors?

"It can be put this way: The demonstration of the complete transformability—not a mere modifiability—of one truly hereditary and chromosome-determined character now makes it quite illogical to assume that any hereditary character similarly founded may not be transformed in and during the life of the individual. It is necessary to emphasize that the reversals studied apply solely to the individual life, not to the hereditary transmission of the reversed character.

"This aspect of our knowledge of heredity and development should ultimately prove of much interest and of very real practical value to mankind. Meanwhile a sound body of knowledge relative to its practical application remains to be developed and this field of study is a difficult one."

Curious Things People Invent

(*Continued from page 23*)

suitable duration to make the worm hungry. The worm seizes the bait, and its head is caught in the trap, which is then withdrawn from the patient's stomach by the string which has been left hanging from the mouth."

In the Patent Office are some wonderful ideas for human comfort and convenience.

A very simple one is a "Snoring Shield," especially devised for the comfort of neighbors in hotels or apartment houses. It is a little oval piece of rubber which the habitual snorer places between his teeth and lips when he retires, "thereby preventing the passage of breath through the mouth."

AMONG the records also is Patent No. 395,515, for a "Chewing Gum Locket," an attractive charm in which the chewer may "park" her quid "with safety, cleanliness and convenience for use." The patent specifications further tell us that "chewing gum may thus be carried conveniently on the person, and is not left around carelessly to become dirty or to fall in the hands of persons to whom it does not belong."

Nor have the inventors neglected the comfort and safety of the dumb creatures. In an "Eye Protector for Fowls," Patent No. 730,918, we have an attractive pair of tortoise-shell goggles for the hen. The purpose is to prevent other fowls from pecking her eyes out.

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Look for more of these unusual inventions in coming issues.

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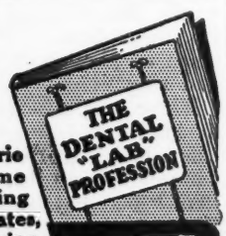

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Men Who Fight Sharks

(*Continued from page 33*)

the current from the outside through the pores.

In its adult stage, the sponge is found always moored to something fixed, such as a rock, or a piece of coral. But when very young it has power to get about, and finds itself a protected place for a permanent home.

As soon as the Captain's first net of sponges was brought on deck they were set upright, in the position in which they had grown. This was to let the animal die, and the jellylike fluid inside drain off. At the end of the day, the sponges taken in the little boat would be transferred to a larger vessel—a kind of "mother ship"—of which there is one for each fleet of the little fishing boats. There the sponges would be cleaned and cured for several days before being sent to land for final treatment, storage and sale.

FROM where I sat, waiting for Captain Cocoris, I could see the mother ship and several other sponge boats riding calmly on the glassy surface of the Gulf. They are exotic looking craft, these spongers. The mother ship is usually a two-masted schooner. The smaller boats carry each a single mast, with a slight rake forward, near the bow of the boat. These little craft have lines such as one sees in the Aegean Sea off the coast of Greece.

"Where do you get these funny shaped boats?" I asked Anagnos.

"We make them ourselves," he answered. "Just the same like what we have in Greece. They called 'trehadire.' They don't tip over and fill with water so easy in a storm."

When the Captain ended our two-hour watch by coming up for a smoke, he told me how he started the modern sponge industry in Florida in 1905. He had been in the trade in Greece, and he found the Florida fishermen using the same primitive methods.

In the Levantine sponge fisheries the divers go naked, as in the pearl fisheries, but "skin-diving" in the waters of the Gulf of Mexico has a hazard greater even than sharks. That is the barracuda—"the tiger of the sea."

TERRIBLE tales are told of the fierceness and voracity of this most dangerous of all fish. The barracuda launches himself directly at his prey from any position or direction, snapping his steel trap jaws as he strikes, and cuts off an arm or a leg easily and cleanly. Indeed, the shark's evil reputation is believed by many to be due to the barracuda, who is no relation at all, being more closely akin to the innocent horse mackerel or tuna.

It was Cocoris who decided to attempt the innovation of putting men into deep-sea diving suits and going out miles from shore after sponges. All of the Gulf is shallow, compared with similar large bodies of water. It is its shallowness which makes its waters warm, the semi-tropical sun penetrating to the depths and so setting up the great ocean river of warm water called the Gulf Stream.

Cocoris' scheme worked fine. "I was success," he told me. A great number of his countrymen speedily followed his leadership. The supply near shore having been almost depleted, the sponge fleets now go a hundred miles out to the fishing grounds and bring in sponges much larger and more valuable than those formerly obtained, and the annual crop of sponges brought into the bayou at Tarpon Springs is worth a million dollars.

"How long does one of these boats stay out on a trip?" I asked Captain Cocoris.

"Three months."

"What? Three months without ever going back to land?"

"YEAH, we go out four, five boats together, and one big schooner, we call a caique. We eat and sleep on the caique, and fish on the little trehadire. We store the sponges we get every day on this caique. Another ship makes trips to get our sponges, and brings us what we need and letters from our wives."

"How do you pass the time out here so long, without getting homesick?"

"We have good time—nice time. We work hard all day, eat nothing all day; only coffee. A diver cannot eat and then work. But at night we go back to the caique, get together for a plenty big meal. Then we play cards, and play mandolin and sing."

These long absences make life ashore a kind of holiday. All the boats come in at the Greek Christmas, on January 19, and there is a great celebration. The Patriarch, or Metropolitan Bishop of the Greek Church, comes down from New York and blesses the sponge fleet. A gilded cross is cast into the bayou, after appropriate ceremonies. Then five selected divers plunge into the bayou to recover the cross. The successful diver is honored with a procession, and the cross he recovers is felt to be purified and potent to give good fortune to the sponge fleet for another year.

Odd Devices You Never See

(*Continued from page 37*)

is said to be one of the best yet evolved.

In the electrical shops, a recent product was an electrical flasher needed for plant research investigations. This device will automatically turn on or extinguish electric lamps employed as substitutes for daylight in speeding the growth of plants.

Still other experts in the mechanical shops make models of wooden equipment such as you never saw or heard of. Their daily labors are adventures into the unknown of woodworking possibilities. One feature of this work which invariably attracts the attention of visitors is the cutting out of life-size figures of men and animals to be used in agricultural displays at fairs and expositions. Photographs enlarged to life-size are pasted to light wooden panels, and each figure is cut out.

These are only a few of the 12,000 tasks which the mechanical shops performed last year, ranging from making little articles costing fifty cents apiece up to scientific inventions which cost $4,000 or more.

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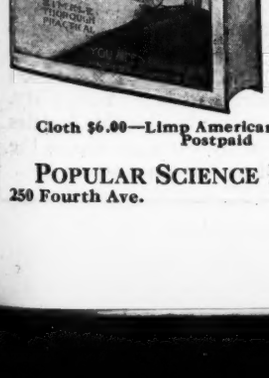

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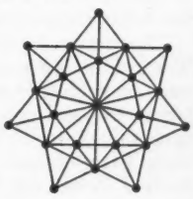
Answers to the Sam Loyd Tests on Page 34

Count the 4-Dot Rows

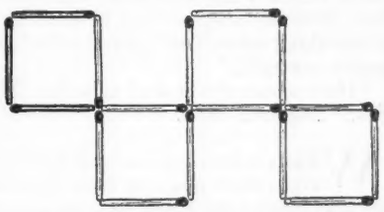


THE diagram shows all the straight lines that may be drawn to produce four-dot rows. There are twenty-one rows in all. If your answer was correct and obtained within ten minutes, you score high in sense of design and form.

The Salesman's Route

THE route through the numbered towns reaches them in the following order: 1, 17, 11, 6, 19, 4, 7, 22, 20, 12, 15, 10, 8, 13, 14, 2, 16, 18, 5, 3, 9, 21 and 23.

The Match Stick Puzzle



THE drawing indicates the position of the matches after moving three to form the lower right-hand square, which maneuver reduces the number of squares from five to four. Accomplishment of this feat in six minutes gives you a good rating for resourcefulness.

How Many Triangles?

THERE are twenty different triangles to be found in the six-pointed star: Twelve little ones; six containing four of the little ones; two large ones containing nine of the little ones.

The Square Addition

2	9	5	6
15	7	16	3
12	14	10	11
8	4	1	13

THE diagram shows how a straight line across the field will score 75 points by entering the squares numbered 15, 12, 14, 10, 11 and 13.

The Column of Figures

THERE are several ways to rearrange the digits to make the total 99, and if you found any of them within five minutes you may go to the head of the mathematics class. One solution is to leave the 6 in the tens column and place all the other digits in the units column.

1
2
3
4
5
67
8
9
99

Invents "Ultra-Microscope"

A CHEMICAL engineer of Switzerland, Charles Spierer, recently invented what he called an ultra-microscope for detecting disease germs too minute to be seen under the highest powered microscope up to now. It is so powerful, it is said, that one cubic millimeter of dry collodion placed under it is seen to contain 60,000,000,000 grains. It is lighted from both sides.

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Ten Ways to Roof Your House

(*Continued from page 36*)

good to me," asserted Rob. "But what is the alibi for hex? Does it have a good toe hold on the roof?"

"Economy answers the first question. The hold is fair enough with two covered nails on each side and at the bottom center an exposed copper anchor that binds each shingle to its neighbors. You notice these little copper projections on such a roof. I should say the hexagonal or similar style needs a steeper roof than the American in order to be weatherproof, and it also demands more insulation beneath. It is advisable to put waterproof felt on the sheathing boards below, except where an old wood shingle roof is to be covered with asbestos shingles. Use the galvanized nails supplied by the manufacturer and also his half-round 'rolls' to cover ridge and hips, if any. Local builders are apt to be careless in these little details, putting in steel nails or anything when they run short of the proper material."

"How about the cost of asbestos shingles?" inquired Rob.

"WELL, a low figure including labor is eight cents a square foot. Remember that labor costs about as much as material. Large units or other labor-saving material naturally reduce total costs."

"While we are shopping around for all sorts of roofs," said Ellen, "I'd like to know a little about slate."

"That is a standard natural material which our ancestors classed with tile. It is durable, rather weighty, more or less expensive. The usual thickness is about one quarter inch, while sizes vary. It has several quiet tones and may even proclaim itself in flamboyant red."

"And what about tile?" she continued.

"It is the heaviest and perhaps the most expensive—in some forms—of all roofing. It has the most variety of shape, including the Mission, Spanish, flat, or shingle tile, a combination of flat and arched called Roman, and a flat-with-bevel style known as Greek. Concrete tile costs less than the usual burned clay product. There are all the colors that you care for. In any sort of a damp climate it is desirable that the clay tile should be glazed. Every detail in the application of such choice material needs extra care, so that the roof is wind- and rain-tight and that the tile will not be blown off in a gale. If you want an attack of acute envy, take a look at a house with a roof of green glazed tile."

"WHAT do you know about copper?" asked Rob.

"It's a royal roofing, and you know royalty is apt to come high," I replied. "However, that copper-surfaced shingle of asphalt base, which I mentioned, is quite low in cost. In fact all-copper is not really expensive compared with other material of its own rank. The most economical use of all-copper is in sheets, which should weigh one pound to the square foot. Strips of soldered sheets are put on the roof up and down, not crosswise. Then the edges are joined either in a standing seam or flat seam. White lead can be used in the standing seam instead of solder, an economy which many roofers do not practice. Anchorage of sheets to the roof is obtained by first-fastened copper cleats which are turned over with the seams. This method avoids having any nail holes through the material and provides for the considerable expansion and contraction of the metal. With a copper roof, use no other metal, whether for cleats, nails, flashings, gutters, leaders or their hangers. There is a reason. And for lightning protection, one leader should be well grounded in moist earth."

"HOW much will copper set us back in the sheet style?" asked Rob.

"The material will cost thirty cents a square foot, maybe less."

"Isn't a tin roof less expensive?" inquired Ellen.

"Yes. And it has to be painted on both sides, and the surface repainted every few years. The first coat should be red lead."

"You said there was a reason for not using other metal with copper," remarked Rob. "What is the reason?"

"Galvanic action tends to eat away one of paired metals. Don't let copper gutters or leaders be fastened with iron in any form. Similar trouble occurs when zinc is in contact with another metal. Zinc, which is excellent for entire roofs as well as their details, is also affected by the acids in red cedar or redwood shingles; so it should not be used along with such shingles."

"I'm surprised that wood would eat metal," quoth Rob.

"It's a fact. If you want to live happily ever after, without metallic or other divorce suits overhead, have a tight roof made of durable and congenial elements."

"We do and we will," laughed Ellen.

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Here Are Correct Answers to Questions on Page 48

1. When there is much dust in the air, light shining through it looks reddish. At sunset the sunlight has to pass through a thicker layer of air than at noon and if the air is dusty at all it is apt to look red.

2. Yes. On a very hot day the pavement may heat the air next to it just as the ground does in the desert and make a tiny mirage.

3. The duck-billed platypus, a curious animal which still lives in Australia. In ancient times many animals did this.

4. Astronomers can calculate the exact place of the moon, sun, etc., in the heavens for any specified time; and also how strongly each of them pulls on the water. By measuring the tides for many years, men have learned how shore lines, ocean currents, etc., affect them. Putting these things together the tides can be calculated.

5. Because the salt increases the water's specific gravity. The water weighs more per cubic foot. This makes your body sink into it less deeply.

6. Yes. We cannot hear a sound if it has less than about thirty vibrations per second or more than about forty thousand per second.

7. If you pass a magnet back and forth across a wire you will produce a little pulse of electric current in the wire each time the magnet goes past. A dynamo is merely a machine for passing a magnet past a wire many times in succession and thus producing a continual series of electric pulses; that is, an electric current.

8. The drawings, paintings and sculptures made by prehistoric man in caves in France and Spain during the Old Stone Age. They are twenty or thirty thousand years old, perhaps much older.

9. There is a gland in the neck, the thyroid gland, which is important to our body and which needs a little iodine all the time in order to work properly. People ordinarily get this in their drinking water or in sea food.

10. He studies the nature of the rock. He tries to decide whether the country is one where much mineral matter has been brought up from below by the rising hot water. He looks along the bottoms of streams where particles of gold may have collected or he examines loose stones in the stream.

11. Because it is harder. This means that the carbon atoms in the diamond are more firmly attached to each other than the atoms in glass.

12. There is nothing scientifically impossible about this but no one has ever invented a way to do it. Some luminous paints store sunlight to a slight extent.

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Insect Wives Don't Coddle Lazy Husbands

(*Continued from page 39*)

contentedly. For this creature is one of four or five insect musicians whose orchestra entertains us every summer. The cricket fiddles by drawing one of its hard wing cases, like a bow, across the other. Drumlike diaphragms amplify the sound until it can be heard hundreds of yards away. Another fiddler is the grasshopper, who draws the shank of one of its hopping legs across wing-case sounding boards.

As in our own world, there are many odd and eccentric characters among insects. The queerest perhaps is none other than the cockroach, one of the oldest creatures on earth in point of ancestry. These troublesome pests are the "wise old birds"; and, withal, so sociable that it is hard to get rid of them. They will eat virtually anything that men will eat, and in addition they have been known to devour the tops of shoes (blacking and all), the paper off the wall, and old clothes. They are especially fond of ink and stale beer. Yet time and again, when experimenters have attempted to slay them by mixing ever so little poison with their food, they have abruptly turned up their noses and walked away.

Another surprising thing about them is the way the mother cockroach goes traveling. When she lays her eggs she carefully arranges them in a little satchel. This she carries about with her until the young are ready to hatch. One observer reports having seen cockroaches moving from one house to another, each mother carefully carrying her own satchel of eggs.

The resemblance of many insect families to ourselves in habits and equipment is oftentimes uncanny. Did you know, for instance, that baby wasps wear little bibs to catch drops of honey that drop down their chins? This discovery was made by the naturalist Fabre when he broke into the nursery of a nest and watched the nurses feed the young. He describes the sight as follows:

"IF WE watch one of the busy wasps we shall see her, with her crop swollen with honey, halt in front of a cell. With a thoughtful air she bends her head into the opening, and touches the grub with the tip of her antenna. The grub wakes and gapes at her, like a fledgling when the mother bird returns to the nest with food.

"The two mouths meet; a drop of syrup passes from the nurse's mouth to the nurseling's. The nurse moves on, to continue her duties elsewhere. Meanwhile the grub is licking the base of its own neck, for, while it is being fed, there appears a temporary swelling on its chest, which acts as a bib, and catches whatever trickles down from the mouth."

The insects have been called man's nearest rivals. Indeed, entomologists in recent years have warned us that they threaten to dislodge us from the mastery of the earth by robbing us of our food and by spreading plagues.

Yet with all their frightfulness, and even while they assail us, they command our wonder and admiration.

He Put Uncle Sam in the Air

(*Continued from page 43*)

He was pilot, mechanic, repair man and weather observer all in one. By sheer force of necessity the soldier became an inventor. For example, in place of the clumsy landing skids which required the use of bulky launching apparatus that was not easily portable, he designed and installed the first set of landing wheels. Again, to prevent being thrown in rough landings or in taking-off, he devised the first pilot's safety belt. In all, he added to the first Army plane at least twenty mechanical improvements.

On the border, Foulois experienced his first active service as an air fighter. Patrolling the border in his machine from El Paso to Eagle Pass, he was shot at by Mexican guerilla bands, and thus became probably the first aviator in history to be fired on by an enemy.

ON ONE of these patrol flights, with Lieut. Phil Parmalee as his passenger and pupil, he encountered a different kind of foe. As they flew above the Rio Grande, the motor went dead and the falling machine plunged into the muddy river. To men accustomed to falling, that was not particularly serious, for both of them could swim. Looking aloft, however, they saw a flock of hungry buzzards swooping upon them. The birds attacked viciously, and it was only when a rancher appeared on the scene and fired a gun into the flock that they were driven off.

Meanwhile the Air Service was growing. With the organization of the Maneuver Division at San Antonio, this Texas town became the school for the future Air Service. A new Wright machine and a machine built by Glenn Curtiss arrived, and by the end of 1911 a dozen planes were in service. Two years later, at San Diego, Calif., Foulois organized, trained and equipped the First Aero Squadron of the Army—the first complete military air unit.

As commander of this unit, in 1916, Foulois, now a captain, led the airmen who served with General Pershing in the chase of Pancho Villa during the Mexican Punitive Expedition.

The Mexican expedition ended, Foulois established the aviation station at Kelly Field, near San Antonio. The next year, upon America's declaration of war against Germany, he helped to plan Mitchel Field. Here it was that he laid the foundations for the air force of today.

In the war emergency, he drew up the $640,000,000 appropriation for air equipment, built up the American air force for active service, and until May, 1918, as Chief of Air Service, A.E.F., commanded all American air activities in Europe.

Today, as commander of Mitchel Field, he is as busy and as enthusiastic as ever in the development of aviation. He still flies about ten hours a month—but he knocked on wood when he told me that in all his fifty crashes he had never been seriously injured!

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CONTENTS
of This Issue

Editorial..... 2
The Cop Always Wins..... 9
By Edgar C. Wheeler
Sanctified Magic..... 12
By G. B. Seybold
On Top in the April Contest..... 14
What's Wrong in This Picture?... 15
If People Yawn When You Talk... 16
By Charles J. McGuirk
Bridging a Celestial Abyss..... 18
What Oil Burner Should I Buy?... 19
By P. E. Fansler
A Coal Gas Diet for Plants..... 21
By Ernest Bade
Curious Things People Invent..... 22
By Edwin Ketchum
Will It Be a Boy or a Girl?..... 24
By Peter Vischer
The First Great Salesman of Science 25
By Archibald Douglas Turnbull
The Army's Greatest Athlete..... 28
By Arthur Grahame
Some People Build Queer Homes!. 30
Big Ones!..... 31
Men Who Fight Sharks..... 32
By Frank Parker Stockbridge
Try These New Brain Tests..... 34
Ten Ways to Roof Your House.... 35
By John R. McMahon
Inventors Whose Odd Devices You Never See..... 37
By G. H. Dacy
Insect Wives Don't Coddle Lazy Husbands..... 38
By Robert E. Martin
Latest Marvels of Science and Mechanics..... 40
He Put Uncle Sam in the Air..... 42
By George Lee Dowd, Jr.
Boys Build Sturdy Models Out of Old Tin Cans..... 44
Eleven Power Machines Launder Your Collar..... 45
Airplane-Auto Folds Up to Fit in Garage..... 46
Chemist Invents a Machine for Cheaper Ozone..... 47
Household Water Softener Runs Itself..... 48
Novel Automobile Body Folds Up. 49
Oddities Caught by the Camera... 50
Now They Plane Wood Electrically 52
Saving the Camp Fire Cook's Hands 53
Cushioned Comfort in an Electric Light Bath..... 54
Sand Scraper Smooths Golf Green. 55
Ways to Shorten Household Tasks 56
What Rheostats Do for Your Tubes 58
A Fascinating New Radio Trick... 59
By John Carr
Radio Personality..... 60
Getting the Station You Want.... 61
By Alfred P. Lane
What Poor Oil Does to a Car..... 62
By Martin Bunn
Useful Ideas for the Autoist..... 64
Home Workshop..... 67
Better Shop Methods..... 74

And More Than Two Hundred Other Articles and Pictures

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Gabriel Andre Petit
Art Director

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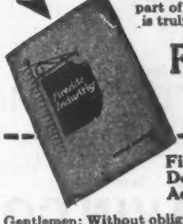

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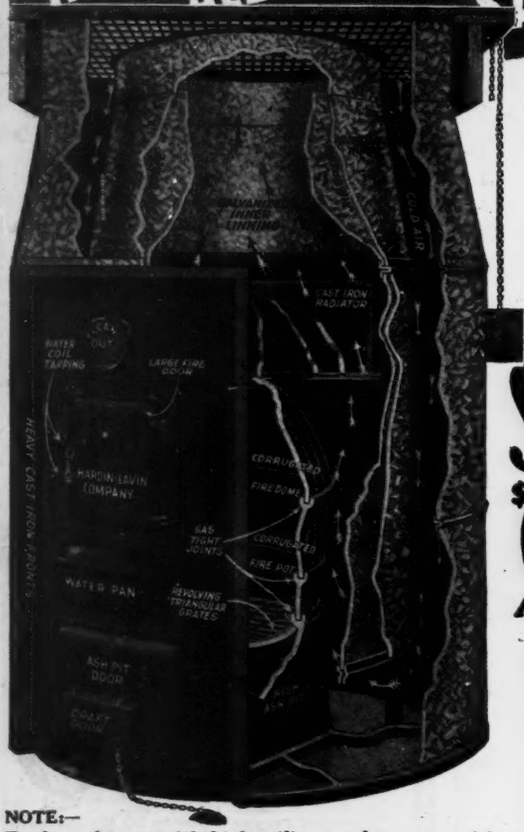

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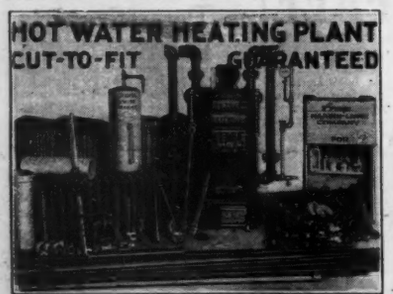

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